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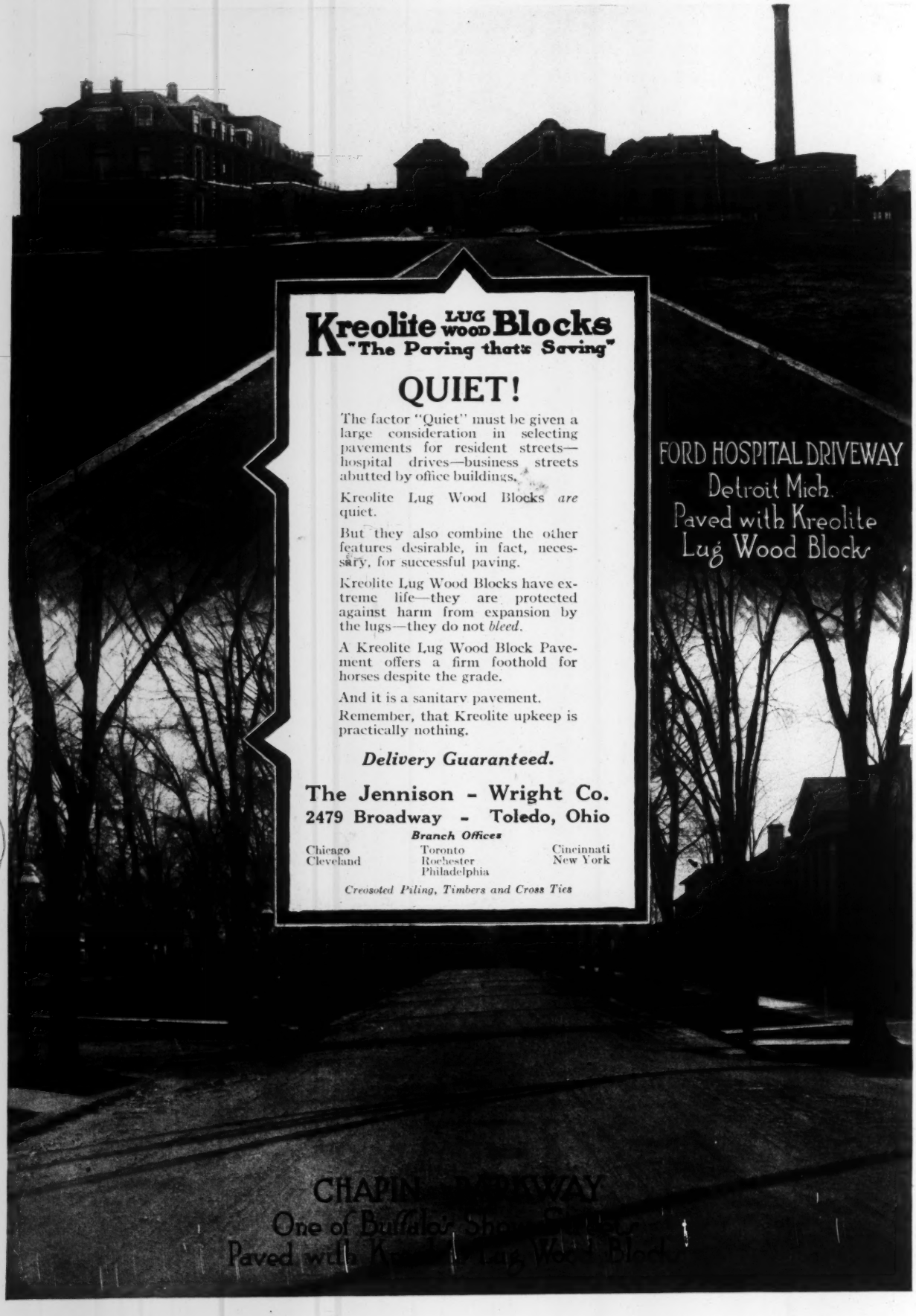

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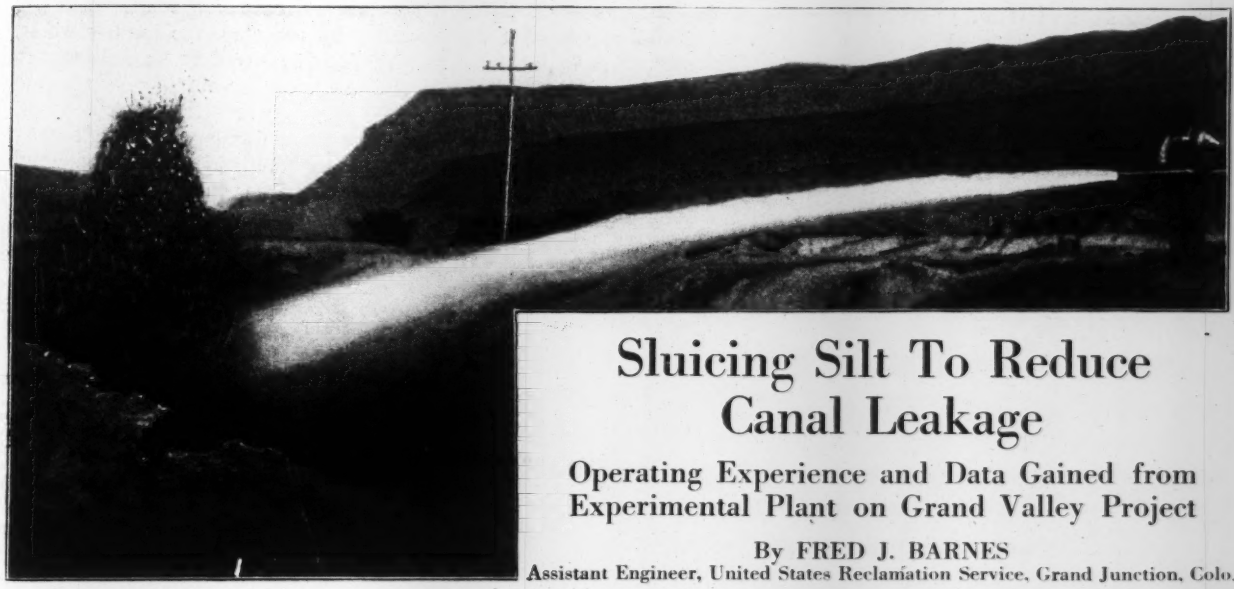


Sluicing Silt To Reduce Canal Leakage

Operating Experience and Data Gained from Experimental Plant on Grand Valley Project

By FRED J. BARNES

Assistant Engineer, United States Reclamation Service, Grand Junction, Colo.

THE MAIN CANAL of the Grand Valley irrigation project of the United States Reclamation Service, in Colorado, is excavated, along the north side of the irrigable lands, largely in porous shale, and the losses from percolation have been excessive. The possibility had been discussed of diminishing percolation by sluicing into the canal clay or fine silt, which would be carried in suspension for considerable distances and finally be deposited in sufficient quantities materially to reduce the losses of water. Previous work had been locally successful in puddling and priming certain sections with rather poor material available adjacent to the canal and brought up with scrapers, but this method was impracticable along many sections where the material was entirely shale and not distintegrated. Few data were available on the equipment necessary for sluicing in the priming material, or on the cost of installation and operation, so that it was decided to install the plant here described to determine experimentally what could be accomplished.

Experiment Made at Camp 4

At Camp 4 there was a small bed of about 8000 cu.yd. of chocolate-colored clay, which it was decided to try. This material was very dense and compact, and in its natural state required a pick to loosen it. It contained 16% moisture and very little sand. The sieve test indicated 100% passing a No. 50 screen, 99.85% passing a No. 100 screen and 98.22% passing a No. 200 screen. The bed was on the upper side of the canal, immediately adjacent to and above the water surface of the canal.

It was decided to install a large motor-driven centrifugal pump on the canal bank, supplying a giant playing on the deposit to loosen and dissolve the clay. It was planned to get the clay thoroughly in suspension by agitation in a sump and to bring the emulsion through a wooden flume for distribution into the water of the canal. It was intended to observe carefully the quantity of water and clay handled, power consumption, erection cost, operation and deterioration of plant, velocity of canal water necessary to hold silt in suspension, and all other data that seemed pertinent or valuable.

Make-Up of Silting Plant

A two-stage centrifugal pump with 8-in. suction and 6-in. discharge was direct-connected to a 75-hp. 890-r.p.m. induction motor mounted on the pump base. A suction sump was built in the canal, and the motor and pump were installed in a small shed adjacent. The discharge line consisted of 40 ft. of 8-in. spiral-riveted iron pipe and 75 ft. of heavy 6-in. canvas hose connected by a flange union to the giant. The latter was mounted on a heavy frame to hold it in position and had counterweights to facilitate handling the nozzle. The giant proper was about 6 ft. long, tapering in inside diameter from 7 in. to 3½. An additional nozzle of 3-in. inside diameter was also provided.

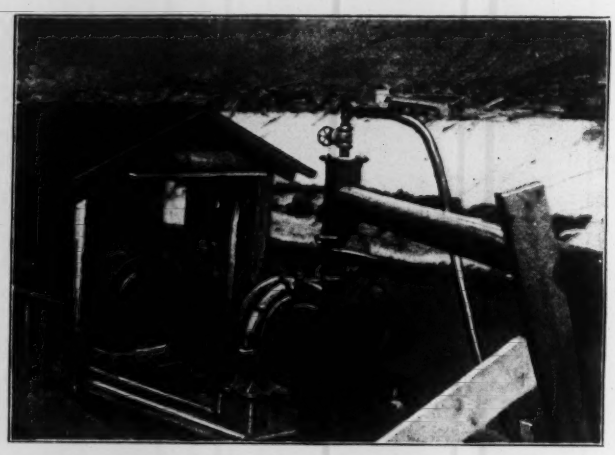
A cut was made through the upper bank of the canal to drain the effluent from the clay pit into the canal. A 2-ft. metal Cippoletti weir was installed in the cut. A wooden flume extended from the weir across the canal, clearing the water surface by 6 in. Notches of varying depths were sawed in the vertical sides of the flume at 2-ft. intervals to distribute the muddy water evenly over the canal flow.

The pump discharge was found to be 3.129 cu.ft. per sec. With the 3-in. nozzle this gave 63.8 ft. per sec. issuing velocity. By elevating the giant, the stream could

be thrown about 150 ft. horizontally. With the 3½-in. nozzle the issuing velocity was 46.7 ft. per sec., and the extreme horizontal range was about 110 ft. One man attended to the motor, pump, pipe line and distributing flume, while a second man handled the giant.

Maximum Force of Stream Utilized

The idea kept in mind was to utilize the maximum force of the stream in breaking down the clay to small particles and getting it thoroughly mixed with the water. It was found most advantageous first to dig a deep hole



WATER WAS SUPPLIED BY MOTOR-DRIVEN PUMP

in one side of the clay bank by holding the giant pointed downward on a small area for 15 min. or so. The sides of the clay bank were then trimmed to a vertical face, and the giant stream was played over this face. It appeared best to keep the stream moving continually over the face of the deposit, so as to remove the material in thin layers rather than to undercut large masses and have them fall into the sump. The clay required considerable agitation before becoming thoroughly mixed.

The crest of the weir in the cut from sump to distributing flume was about 2 ft. above the bottom of the sump, so that this served as a settling basin for larger lumps. The sump floor was kept at this elevation by occasionally turning the giant stream downward and keeping it pointed on one place for a short period. After the clay became thoroughly saturated, it mixed with the water readily and remained in suspension for about 60 min. in still water, although some precipitation began immediately.

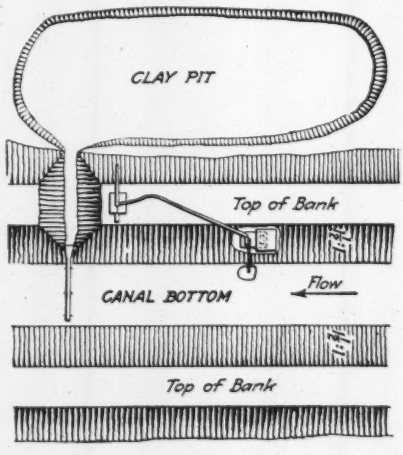
The effluent passed the weir with a vertical fall of 2 ft. and was carried out in the wooden flume with a velocity of about 5 ft. per sec. over wooden riffles on the bottom, which tended to grind up still more any pieces of clay that had been swept along. Samples of effluent were taken at 2-hour intervals to determine the percentage of clay carried in suspension. These samples varied widely, showing from 4 to 5% of clay by weight; the average clay content, as indicated by samples, was 5.4%. The total running time was 83½ hours, during which period 941,000 cu.ft. of water left the giant. The total amount of clay moved out, determined from cross-sections of the bank before and after sluicing, was 2749 cu.yd. This indicates 7.88%, by volume, of clay in the water.

The effluent fell from the notches in the flume sides vertically about 10 in. and seemed to mix rapidly with the clear water. The canal at this point has a base width of 40 ft. The flow at the time varied from 60.5 sec.-ft. to 75.2 sec.-ft., and the area of the water section averaged about 60 sq.ft., so that the mean velocity of the canal water through the 700-ft. section from the distributing flume to the upper portal of Tunnel 3 was a little in excess of 1 ft. per sec. By the time the muddy water reached the tunnel portal, it appeared to be well mixed with the clear. It received further mixing in passing through the tunnel (1.4 miles), where the mean velocity was 4.75 ft. per sec. and there was considerable turbulence. Observations of canal velocities were made at numerous times and places, beginning at the lower portal of Tunnel 3. Samples of the water were taken, and the silt content was determined, to ascertain what velocity was necessary to prevent too rapid precipitation of the burden.

The canal below the lower portal of Tunnel 3 has a very irregular section. In some places the bottom width changes abruptly from 24 to 50 ft. for a distance of several hundred feet, and the canal was excavated several feet below grade. Here, abrupt changes in velocity occur. Float measurements showed from 0.39 to 2.38 ft. per sec., but the actual mean velocities were probably much less. The average velocity through the section from the lower portal of Tunnel 3 to the Lewis siphon (8.8 miles) by float measurements was 0.81 ft.

Rapidity of Silting Not Determined

On account of the rapid succession of abrupt changes in velocities, the rapidity with which the silt dropped could not be accurately found. It was observed that there was little tendency toward separation when the ve-



SKETCH PLAN OF GRAND VALLEY SILTING PLANT

locity exceeded 1 ft. per sec.; but when the mean velocity dropped abruptly from 1 ft. per sec., or more, to 0.4 or 0.5, there was immediate precipitation. Only slight quantities of silt were carried as far as Lewis siphon; the bulk dropped out in the first 2 miles below the tunnel.

The largest observed percentage by weight of silt in the canal water immediately below the silting plant (and due entirely to the plant operation) was 0.48%. At Lewis siphon the largest observed content was 0.002%, indicating practically complete precipitation in 8.8

miles—neglecting the 1.4 miles of tunnel where precipitation was impossible.

The obvious conclusion is that for best distribution the velocity of the current in the canal should exceed 1 ft. per sec., except where it is desired to deposit the silt.

Pumping-Plant Performance

The pressure head was found by gage, but no vacuum gage was available, so that the suction head had to be computed. The total head thus found was 135.2 ft., using a 3½-in. nozzle. The theoretical horsepower required was 48.3; the actual power consumed was 60 kw. at the Cameo power station, giving a combined efficiency for the transmission line, motor and pump of 60%. Using a 3-in. nozzle, the total head worked against was 160.7 ft. This required 57.3 hp. theoretically, and the actual consumption was 72.3 kw., making the combined efficiency then 59.2%.

NOTCHED SLUICE CARRIED MUD TO CANAL

When working the stream against a vertical face of the bank from a distance of 40 ft. or less, the 3½-in. stream seemed as effective as the 3-in., with much less power consumption. At greater distances or when digging was required, the 3-in. stream worked faster.

Summary of Plant Costs

The installation cost of the silting plant was largely in repairs to the pump (an old one in poor condition) and labor of erecting the pump, motor house, pipe line, distribution flume, etc. All material was old stuff lying around Camp 4. The transmission line was already built. No depreciation charge was allowed on machinery, since much overhauling was necessary and the pump was in better condition after sluicing ended. The cost of power was comparatively high—$0.0347 per kw.-hr. in September and $0.0384 in October (because of the small power output for these two months at the station and the relatively high influence of fixed charges).

The accompanying tabulation summarizes the cost figures. This table includes all items of cost charged against the work, except one item of $145.66 for giant, pipe and fittings, all of which were in as good condition after the work was completed as when received.

COST OF GRAND VALLEY CANAL-SILTING OPERATIONS

	Total Cost	Per Yd. of Clay
Plant erection, labor	$181.92	$0.066
Plant erection, materials	3.01	.001
Plant operation, labor	107.00	.039
Plant operation, materials	4.61	.001
Plant demolition, labor	100.52	.037
Power	186.95	.068
Engineering	153.65	.056
Closing entries (automobile expense, etc.)	63.00	.023
Total	$800.66	$0.291
Total clay moved, cu.yd.		2,749.0
Total power used, kw.-hr.		5,290.0
Power used, kw.-hr. per cu.yd. of clay		1.92
Hours of plant operation		83.5
Water pumped, sec.-ft.		3.129
Clay in suspension, %		7.88
Total head on pump using 3½-in. nozzle, ft.		135.2
Total head on pump using 3-in. nozzle, ft.		160.7
Approximate combined efficiency of transmission line, motor and pump, %		60.0

No data are available at the present on the uniformity of the silt deposited over the wetted area of the canal, nor on the efficiency of the clay in diminishing percolation losses.

Large Drainage Project in Northern Indiana

The Calumet drainage ditch in northern Indiana, work on which is expected to begin this season, will reclaim a swampy district lying east of the Little Calumet River; and by reversing the flow of this river it will afford relief to the Sag Canal of the Chicago drainage-canal system. The ditch will have a flow eastward to Lake Michigan, discharging into the lake much water that now drains toward the river, so that the new Sag Canal will be able to care for the flood flow of this river without difficulty. The drainage ditch will connect with the Little Calumet and its tributary the Deep River, about 2½ mi. southwest of Gary, Ind., and will follow approximately the channel of the former to a point near Dune Park, where it will turn north and discharge into the lake. Its length will be about 9 miles. A 1½ mile branch will connect with Salt Creek and run west to the main channel.

The bottom width will be 70 and 50 ft. in the main channel and 40 and 50 ft. in the branch. The side slopes will be 1 on 1, except that for about a mile through the sand dunes near the outlet they will be 1 on 2. The depth of cut will be 5 to 57 ft. (the maximum being in the cut through the dunes), and about 2,650,000 yd. of excavation will be required.

Contracts amounting to $227,400 were let in 1914; but work was not commenced, as the railways claimed that the cost of the various bridges required should be borne by the drainage district. This case has been decided by the United States Supreme Court in favor of the district. Action has been taken recently by the Northern Illinois Public Service Co. seeking to restrain the district from diversion of water from the Little Calumet. It is hoped, however, that this suit will be disposed of in a short time.

Elevated Railway Rebuilt Without Stopping Traffic

The Structure Is Raised to New Grade, Spans Are Changed and Truss Spans Converted to Plate-Girder Viaduct

ONE of the most extensive of the numerous changes made in the Chicago elevated railways to adapt them to altered conditions is that of raising the grade and changing the structure of the Metropolitan line which crosses the site of the new Union Station (owned by the Pennsylvania Co.). This is a four-track line carrying very heavy traffic, but all work was done without interference with traffic, except that one track at a time was closed for short periods to enable the old structure across Canal St. to be removed and a new structure put in place.

The Problem

The situation is shown clearly in Fig. 1. The elevated railway crosses the property of the Union Station Co. by two 2-truss pin-connected through spans of 157 and 240 ft. The outer ends of these spans are carried by steel bents, the one at the west end being a rocker bent, while their inner ends are carried on a stone pier that is on a skew with the bridge in order to come between the tracks beneath. Beyond the railway property is the typical elevated-railway structure of plate girders and columns.

The raising of Canal St. in connection with the new Union Station improvements made it necessary to raise the elevated line about 3 ft. at this point. East of this street the two truss spans are raised so as to give a grade of 0.753% for 406 ft. from the old elevation at the river to the new elevation at Canal St. West of this street, the girder structure, including the elevated railway station, is raised to give a grade of 0.755% for 404 ft. from the old elevation at Clinton St. to the new elevation at Canal St. The span over this latter street is on the level.

It was considered by the Union Station Co. that the truss spans would be an unsightly feature in the surroundings of the handsome new station, and the elevated-railway company agreed to remove them. An interesting feature in the work is that the present floor system and deck will be retained, the floor-beams being carried between longitudinal girders supported by columns arranged to suit the layout of tracks and platforms below. When these supports are in place, the trusses will be removed.

Raising the Truss Spans

To change the truss spans to the required grade, it was necessary to raise the west end of the 240-ft. span 3.05 ft., and the adjacent ends of the two spans (on the pier) about 18 in., leaving the east end of the 157-ft. span unaltered. The maximum lift was given by jacking and raising the old rocker bent at the west end, as described below. The more difficult and interesting problem was the raising of the ends of the two spans on the masonry pier. As all four tracks on the bridge were kept open for traffic, there was very little working space available inside the trusses.

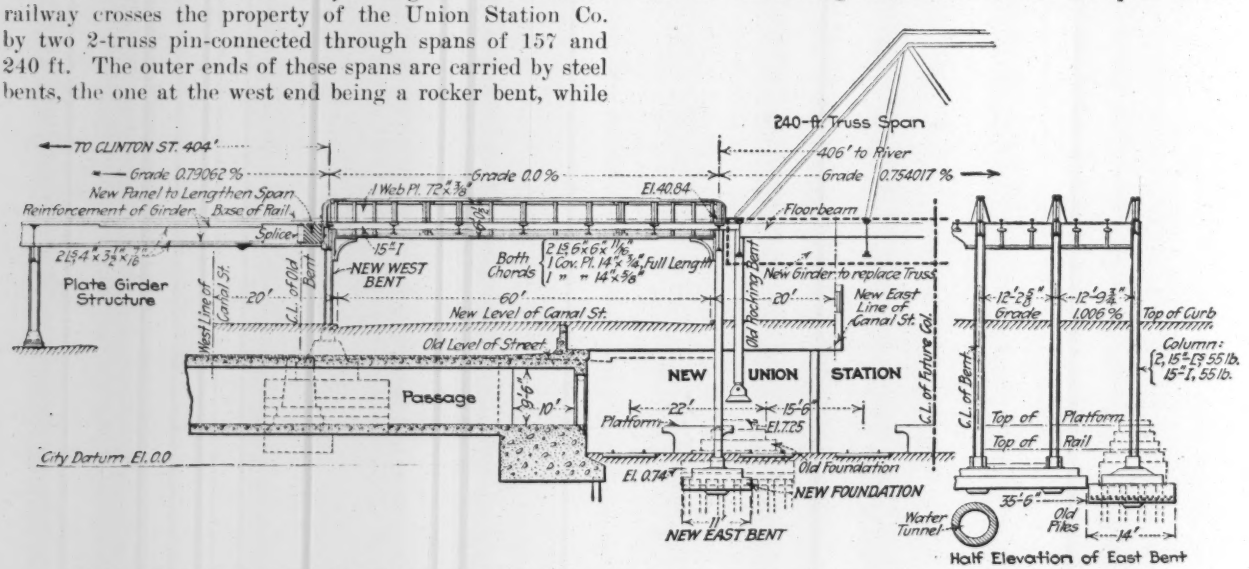


FIG. 1. CHICAGO ELEVATED RAILWAY RAISED AND ALTERED WITHOUT INTERRUPTING TRAFFIC

It was found that by good fortune the truss shoes had holes cored in them, and these were utilized for placing 4½-in. pins of such length as to carry the loops of hangers on each side of the truss. The upper ends of these hangers were threaded and were held by nuts on bearing plates carried by groups of I-beams under which the lifting jacks were placed. The pins were designed for a unit stress of 25,000 lb. per sq.in. under maximum load, with the four tracks fully loaded. Bushings of soft copper were fitted between the pins and the shoes, so as to insure a uniform bearing. The blocking and I-beams were placed first; then the hangers were attached, and the pins were placed in position. The hangers were then drawn up tight against the pins.

For raising the spans, jacking beams parallel with the trusses were placed on each side of each truss, supported on screw jacks and blocking. Upon the jacking beams were placed short crossbeams, three to each set, and upon these

were the bearing plates carrying the nuts on the threaded ends of the hangers. By turning the jacks the beams were raised, thus lifting the trusses by means of the hangers carrying the pins in the truss shoes. The arrangement of jacking beams and lifting hangers is shown in Fig. 3.

The top of the pier was not large enough to carry the number of jacks required to give the necessary lifting power. A timber bent was built therefore alongside the pier to carry the extended ends of the blocking on which

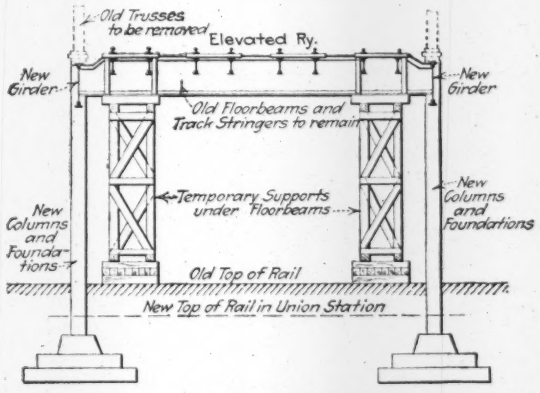

Old Trusses to be removed
Elevated Ry.
New Girder
New Girder
Old Floorbeams and Track Stringers to remain
Temporary Supports under Floorbeams
New Columns and Foundations
New Columns and Foundations
Old Top of Rail
New Top of Rail in Union Station

FIG. 2. METHOD OF CONVERTING FLOOR OF TRUSS SPANS INTO A PLATE-GIRDER STRUCTURE

the jacks were mounted. The spans being raised, an I-beam grillage was set under each shoe at the new elevation, and concrete was filled in and around the grillage.

Converting Truss Spans to Girder Spans

One of the features of special interest in this work is the conversion of the heavy four-track, pin-connected, through-truss spans into a viaduct with plate-girder spans. This change, as noted above, is for the sake of appearance. The present floor system and deck of the truss spans will be retained, but the floor-beams will be framed between new longitudinal plate girders, about 9 ft. deep, instead of between the truss posts (Fig. 1). These girders will be on the same center lines as the trusses and will be framed between the tops of columns. The spacing of columns, and consequently the length of the girder spans, will be made to fit the track layout of the station below.

The general method of doing this work is shown clearly in Fig. 2. Timber bents will be erected under each floor-beam, so as to carry the deck and relieve the trusses of load. The floor-beams will then be cut loose, and the lower ends of the truss posts, beneath the bottom chords, will be removed. The new columns and longitudinal girders will then be placed, and the floor-beams will be riveted to these girders. With the old deck thus converted into a viaduct, the trusses will be removed.

Raising the Elevated Railway

In raising the 404-ft. stretch of four-track structure west of Canal St., including the elevated station, the lift varied from 0 to 3.05 ft., to give the required grade. This structure consists of columns carrying cross-girders framed between them, and between these girders are framed the longitudinal girders or track stringers, forming spans of 38 to 45 ft. The station platforms are carried by lattice girders resting on the cross-girders. The structure is of considerable width at this point, partly due to the two island platforms and partly to the necessity of placing the columns outside of an incline approach to the Van Buren St. tunnel. Thus the total width over the cross-girders is about 100 feet.

The line being changed from level to an incline, it was necessary to cut the cross-girders and the knee-brace brackets free, in order to allow the columns to stand vertical. The attachments of the longitudinal bracing also had to be changed, but the track girders were not cut loose from the cross-girders.

Framed bents were built at each column and jacked up to carry the cross-girders. As soon as the connections were cut and temporarily bolted, the raising was done by means of 15-ton house-raising screw jacks. This was done simultaneously over the entire length of 404 ft., no bent being raised more than 2 in. at one time. Blocking was built up under the baseplates of the columns as the

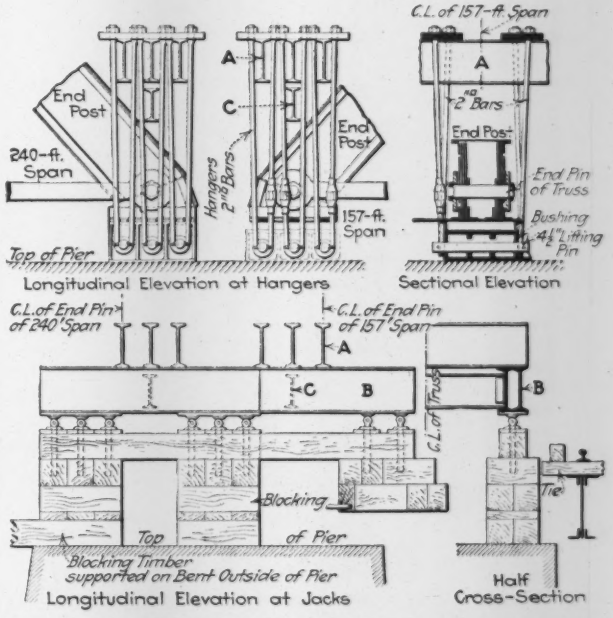


FIG. 3. JACKING ARRANGEMENT FOR RAISING TRUSS SPANS ON PIER

raising progressed, and the anchor bolts were spliced by means of sleeves.

Reinforced-concrete caps were then built on the old pedestal footings to raise them to the required elevation. The caps were left for at least two weeks before transferring the column loads to them. In the meantime the old holes of the riveted connections of the cross-girders to columns and brackets were reamed and the connections riveted up. The station stairways and their supporting columns were raised bodily with the rest of the structure, the column pedestals being capped with concrete and the stairs extended to the ground. These stairways were kept open for use at all times.

Changing the Canal St. Span

As Canal St. will be widened as well as raised, a single through-girder span of 62.6 ft. was required to replace two old deck spans. This new span (shown in Fig. 1) is fan shaped, carrying the four tracks as they diverge for the station platforms. It has five girders, thus

permitting the structure to be erected for each track separately. Its ends are carried by new bents, which are so close to the old ones as to introduce difficulties in the construction of the foundations.

The new arrangement requires additional columns in the east bent, adjacent to the truss span. In the old structure the two-column rocker bent carried a cross-girder against which the longitudinals were framed. With the new design it was necessary to use five columns, one under each girder. This work involved trouble,

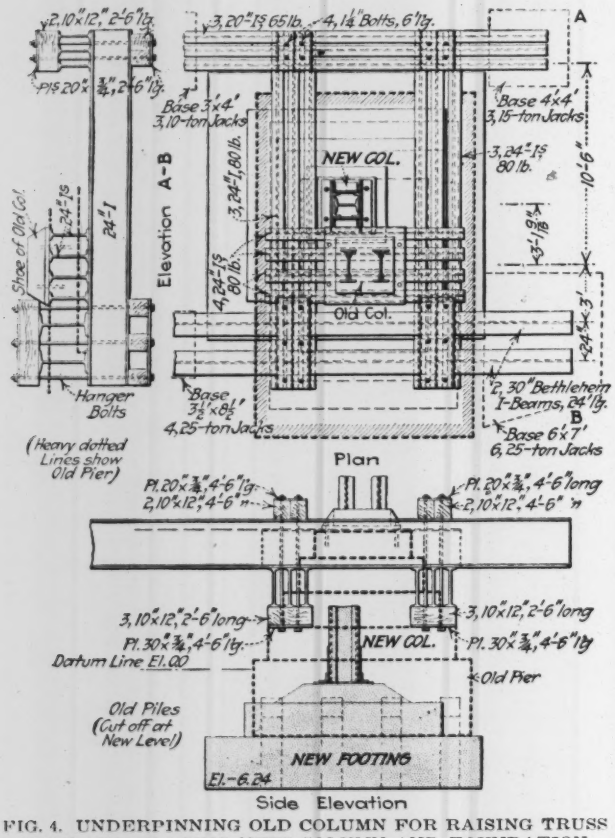


FIG. 4. UNDERPINNING OLD COLUMN FOR RAISING TRUSS SPAN AND PLACING NEW COLUMN AND FOUNDATION

due to the existence of a water tunnel under the middle of the bent, so that foundation piles could not be driven. To provide for this condition the three middle columns are carried by a continuous reinforced-concrete footing 35½ x 11 ft., just above the tunnel, as shown.

This east bent comes in the trainshed of the new Union Station (which extends back 40 ft. under Canal St.), and its footings have to be at a much lower level than the old footings. The columns, therefore, are about 40 ft. high. They will be braced, however, at a height of about 24 ft. by connections to the framing of the new sidewalk.

One of the troublesome jobs was to place the foundations of the two end columns of this bent, the old and new columns being only $37\frac{9}{16}$ in. c. to c. This was the more difficult, since the old ones formed a rocker bent carrying the end of the adjacent truss span, the columns having pin bearings in the shoes. The new columns had to be carried down through the old footings to new and lower footings, as noted already.

The method adopted is shown in Fig. 4. The first step was to place four 24-in. I-beams, 10 ft. long, under the old column shoe. The masonry under one side of the shoe was cleared away sufficiently to permit inserting one beam. Then the one at the opposite side was placed, and then the two middle beams, each one being in place and supported before removing material for the next one.

This being done, a set of three I-beams 16 ft. long was placed under each end of the 10-ft. beams, their length permitting them to be supported on concrete blocks at points well outside the work for the new column. The next step was to place above each end of the 16-ft. girders a set of 24-ft. girders, also supported on concrete blocks or footings. Timbers above and below these tiers of girders were connected by hanger bolts, so that the 16-ft. beams (carrying the support of the old column) were suspended from the 24-ft. beams. This arrangement gave ample room for working under the old column, to remove its foundation and place the new footing. This steel grillage was utilized also in jacking up the column to the new elevation of track. The old column will be left upon its supporting grillage of beams until the trusses are removed, at which time the rocker bent will be taken out and the bridge-floor stringers extended 2 ft. to the cross-girder of the new bent.

The new concrete-slab footing comes within the area of the old conical pedestal and is built upon the old timber piles, which were cut off at the required elevation, about 6 ft. below the water line. They were found to be in excellent condition after having been 20 years in the ground.

One Track at a Time Closed

For the erection of the new span over Canal St., one track at a time was closed to traffic. With the southern track closed, two girders were placed, one on each side, and then the old deck and stringers were removed. The floor-beams, with gussets attached, were then swung between the girders and riveted, after which the new I-beam stringers and bracing were placed, making the floor ready for the track. With this track reopened and the next one closed, the third girder was erected, old stringers were removed, and new floor system was placed.

With the third and fourth tracks closed in succession, the fourth and fifth girders were placed and floor systems built in the same way. As Canal St. is closed to traffic, except for one sidewalk, the work could be handled conveniently from below, plant and material being placed in the street. The girders, about 14 tons each, were raised by a gin pole placed on the ground below. A portable air-compressor plant for the pneumatic riveters was installed in the street.

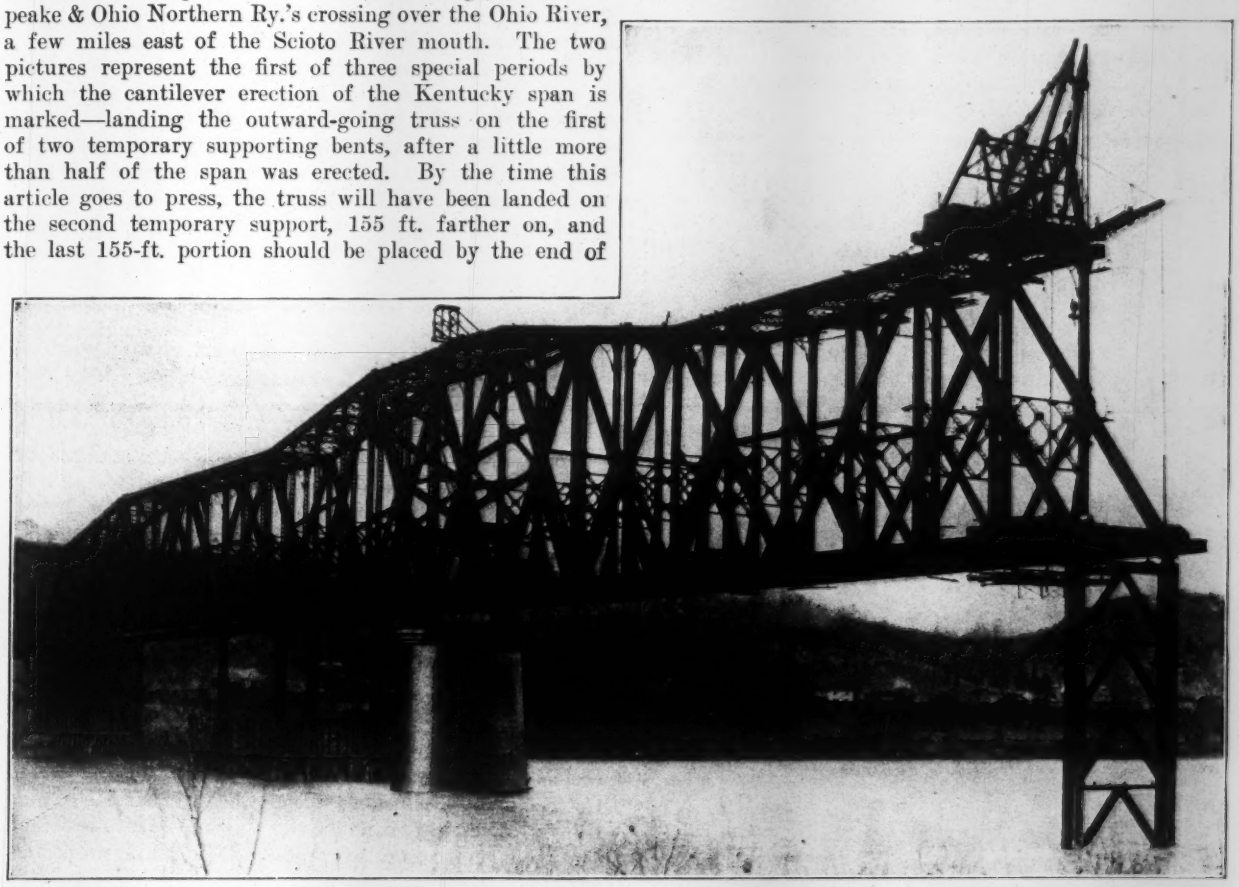
The new west bent of the Canal St. span is 4½ ft. from the old bent, as shown in Fig. 1. To fill this gap, it was necessary to increase the length of the old longitudinals of the adjacent span by splicing in a 4½-ft. panel. While this work was being done, the rails were carried across the opening on steel stringers of trough section, whose ends rested on the track ties at either end of the gap. The lengthened girders were reinforced by additional flange angles.

The alterations and reconstruction were planned by C. M. Mock, chief engineer of the Metropolitan West Side Elevated Ry. The work was done under his direction by the Brennan Construction Co., of Chicago. The plans were subject to the approval of Thomas Rodd, chief engineer of the Union Station Co.

Will Soon Complete Sciotoville Continuous Truss Bridge

Two 775-Foot Spans of Novel Structure To Be Finished Before June—Cantilever Erection of Kentucky Span Progressing Well

GOOD progress has been made in the erection of the two 175-ft. spans of the Sciotoville bridge, the Chesapeake & Ohio Northern Ry.'s crossing over the Ohio River, a few miles east of the Scioto River mouth. The two pictures represent the first of three special periods by which the cantilever erection of the Kentucky span is marked—landing the outward-going truss on the first of two temporary supporting bents, after a little more than half of the span was erected. By the time this article goes to press, the truss will have been landed on the second temporary support, 155 ft. farther on, and the last 155-ft. portion should be placed by the end of May, bringing the end panel-point of the span to its bearing on the Kentucky shore pier.



KENTUCKY SPAN OF SCIOTOVILLE BRIDGE REACHED THE FIRST TEMPORARY SUPPORT APRIL 21, 1917, WITH 465-FOOT PROJECTION

The work has proceeded according to program, with, however, a change of sequence of operations from that originally planned, on account of the shortage.

Work on Ohio Span Rushed

The Ohio span was erected on falsework, as pictured in *Engineering News*, Jan. 4, 1917, p. 28. It was completed late in January. The original schedule contemplated having the cantilever work of the Kentucky span so far advanced, by this time, that it would be within one panel (38¾ ft.) of landing on the first temporary bent. But when labor shortage delayed the progress of the work, attention was concentrated on the Ohio span, so as to complete this and make it self-supporting as soon as possible—the high-water season approaching. In case the falsework were washed out, the Ohio span would then be a simple truss bridge, with high but safe stresses.

Only three subpanels of the Kentucky span—those resting on falsework—were completed by this time. Cantilever erection was then started, the work being done by a creeper traveler moving along the top chord. When the truss was built out 11 subpanels, or 426¼ ft. (to L9 Ky.), the Ohio end of the structure was jacked up by forces of about 1000 tons under each truss, a distance of about 7¾ in., to its final elevation (this end having been erected that much too low, with the bottom chord deformed to a predetermined camber curve). Thereby the steel falsework supports at L4, L8 and L12 Ohio were finally released (the count of panels is from either end pier, L0 Ohio and L0 Ky. respectively).

Jacks Raise Bridge Members

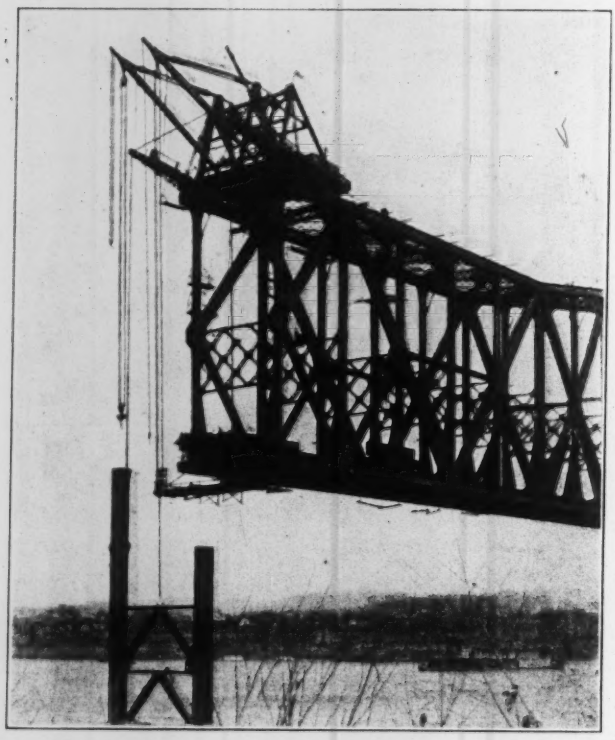
On nearing the location of the temporary bent at L8 Ky., the creeper erected this bent and then finished the truss panel L9-L8, landing it on the bent. Jacks were placed here, and by applying about 240 tons lifting force per truss the L8 Ky. point was raised 7½ in. This jacking was required for the double purpose of giving clearance at the subsequent supports and avoiding undue increase of stress in certain truss members.

Precisely the same procedure is being followed at the second temporary support, at L4 Ky. The jacking here, which determines the clearance secured at the end support, is limited by the necessity of limiting the maximum subsequent load on the L4 support. The Kentucky end of

the span will land about 12 in. low and will then have to be jacked up to its final elevation. The jacking heights and loads at the four points above referred to (some jacking that had been done in the Ohio span prior to its completion is not here included) are approximately as follows:

Jacking Point	Height, In.	Lifting Force Per Truss, Tons
L 0 Ohio	7⅜	About 1,000
L 8 Ky.	7⅝	240
L 4 Ky.	11	220
L 0 Ky.	12	1,000

The Ohio span is complete as to steelwork, but is not fully riveted, though largely. The Kentucky span is practically all riveted as fast as placed.

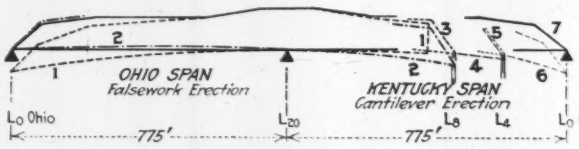


CREEPER TRAVELER SET UP THE TEMPORARY BENT

Of the 13,200 tons of steel in the two 775-ft. spans, about 10,000 tons had been placed by May 5, 1917, when the advance had reached L5 Ky.

Connections Between Members Forced

The prime characteristic of the Sciotoville erection work is that the truss members are deformed (bent) during erection, in such a way as to produce in them the reverse of the secondary bending caused by the load. This required that all connections between members be forced. In the Ohio span it involves little more than jacking from the falsework (deforming the truss as a whole during the progress of the erection). In the Kentucky span the lower-chord jacking had to be done from a flying bridge, consisting of a transverse girder under the floor, hung from lateral outriggers at the forward end of the creeper traveler. The jacks rested on this girder. Pulling the posts (and some diagonals) to their connection at the top was done by pulling up on them by means of a clamp-and-jack rigging.



SEVEN CONDITIONS OF SUPPORT AND DEFLECTION OF SCIOTOVILLE BRIDGE

1—Ohio end 8 in. low, as erected; cantilever end nearing first support. 2—Ohio end jacked up; cantilever then extended to supporting bent. 3—Cantilever end jacked up on bent. 4—Erection carried 155 ft. farther to second bent. 5—Cantilever end jacked up on second bent. 6—Erection continued to Kentucky pier. 7—Kentucky end jacked to final level

The work has progressed without structural accident of any kind. The riveting has gone along well, even on the 1¼-in. chord-splice rivets. In the early stages of the work there was a fair percentage of rivet cutouts, due to lack of experience of the riveting gangs, but this has decreased to a low figure.

The bridge is being built under the direction of Gustav Lindenthal, consulting engineer; O. H. Ammann is principal assistant engineer. For the contractor, McClintic-Marshall Co., P. L. Wolfel is chief engineer and E. A. Gibbs is manager of erection.

Bureau of Standards Wants Data on Alloys

To compile the present state of knowledge and practice concerning the properties of engineering alloys and the numerical values applied to their service, the United States Bureau of Standards is sending out inquiry blanks. It asks the widest coöperation in getting together the desired data.

The blanks give a lint to each of the following items: Name of metal or alloy; State or condition; Chemical composition and impurities; Density; Shrinkage coefficient; Tensile strength; Yield point; Elastic limit; Elongation in 2 in.; Reduction of area; Brinell hardness; Scleroscope hardness; Behavior in compression; Frictional coefficient (steel); Abrasion resistance; Melting range; Coefficient of expansion; Specific heat; Thermal conductivity; Electrical conductivity; Temperature-resistance coefficient; Resistance to corrosion; Hydraulic properties; Optical properties; Miscellaneous (including any other known property).

Blanks will be furnished by the bureau upon request, or they may be made up by anyone by entering the items just quoted along the left-hand edge of an 8 x 12½-in. sheet.

The alloys for which data are specially desired by the bureau are:

Aluminum and its different light alloys with zinc, copper, etc., of stated percentages; nickel, Monel metal and copper-nickel alloys; aluminum bronzes, such as Al 7-Cu 93, Al 10-Cu 90, etc.; manganese bronzes, cast and wrought; phosphor bronzes, such as Cu 80, Sn 12, Pb 7, P1, etc.; Muntz metal, naval brass, Tobin bronze, and brass of 60 Cu-40 Zn; yellow brass of 70 Cu-30 Zn, the red brasses and other brasses; bronzes of 90 Cu-10 Sn, 88 Cu-10 Sn-2 Zn, 88 Cu-8 Sn-4 Zn, and their modifications with Pb and Fe added, etc.; bearing metals; white metals, etc.

Without restriction to this list, however, information on any other metals or alloys will be appreciated as part of this statistical collection of data.

Water-Works Men Discuss Problems at Convention

Abstracts of Some of the Papers Presented Last Week at the Thirty-Seventh Annual Meeting of the American Water-Works Association in Richmond, Va.

To Increase Usefulness of Water-Works Association

Leonard Metcalf, in Presidential Address at Richmond Convention, Outlines Opportunities for Service

OPPORTUNITIES of service for water-works men, both individually and collectively, were discussed last week by Leonard Metcalf, consulting engineer, of Boston, in his presidential address before the annual convention of the American Water-Works Association, at Richmond, Va. One of the association's objects, he held, should be to reach the practically trained man rather than the highly educated technical graduate. Mr. Metcalf criticized in frank terms committees of engineering societies which allow their work to lag, making little or no effort to act or even to accumulate evidence between conventions. He also spoke of the interrelation of the national society with its local sections and concluded with a plea that water-works men bring to the attention of public service commissions or other regulatory bodies the financial difficulties in which many water-works now find themselves as a result of the rapid advance in wages, cost of materials, and standards of service, due to war conditions. Extracts from Mr. Metcalf's address follow:

Service for Rank and File

This association should pause at this time to consider whether it is meeting its full duty to the public and is filling and cultivating its field as thoroughly as possible. . . . . We should strive to reach and serve the general practitioner, the practically trained man, rather than the highly educated or technical one; to give to this large class of capable, intelligent, industrious and able men the opportunity not only to get together in annual convention, but to assist in developing and advancing the state of the art in their particular fields of activity. . . . . It is the essential problem of the national society, whatever its field of activity. It is two-fold in nature, due first to the widely scattered membership, making frequent intercourse about a common board impossible, and second, to lack of financial resources, conducing to the same end. . . . . The primary difficulties seem to lie in the lack of unity of purpose and in the committee work, largely in the lack of method. . . .

Duties of Officers

There are just two features of the administration of national societies about which there can be no real argument. The first is that the duties of the different officers and committees must be clearly defined and not overlap, so that there can be no question as to the responsibility for each function of the society. The second feature is that every officer and committee must clearly recognize the limitations to freedom of judgment. These spheres of responsibility must be thoroughly recognized by each officer and committeeman and they must cooperate freely and fully. . . . .

Has committee work in this association always been approached in a serious vein? Have we given to committee work the careful and conscientious thought and labor which it deserved? Have we always had the broad, sound and well-considered reports, which we have had a right to demand? I submit, not, and I say it with deep regret, with a full appreciation of the difficulties inherent in the task and in the position of the busy individuals involved.

Committees That Do Little

Is it not true that we have had many committees continued from year to year, making little or no effort to act or even to accumulate evidence between conventions, and accomplishing but little? Contrast this with the constructive, productive and valuable work of the committees of the American Railway Association, of the Society for Testing Materials and others, or with the work of some other committees of our own. . . .

May we not, then, demand service? We have the right. We need only the determination. Once it is realized that this association demands such service and will set its seal of approval on no other, it will get it, for men are ever ready to serve under a high standard and where creative work is the first aim. We would do far better not to appoint committees to unattainable, undefined, difficult tasks, than to tolerate a drifting do-nothing policy.

Our difficulties in the past which find parallel in many societies, in our legislative bodies and in American society at large, are to be explained readily through distance between members, lack of understanding, unfamiliarity with committee work or want of initiative, but none of these difficulties are insurmountable. The American Society of Civil Engineers has recently been through like experiences and was finally driven to curtailing, directing in some cases, and following in its committee work, in others, and these things were done with good result.

A Few Remedies

The solution of this particular difficulty in our Association may lie in the suggestions that:

First, we develop better team play;

Second, the committees have their allotted work more clearly defined;

Third, the committees be made to appreciate their opportunities and sources of information, as well as their obligations to the Association;

Fourth, the committees be instructed to carry on all correspondence between individual members of the committee in manifold, that is, by sending carbon copies of all committee letters, reports, data or discussions, to all members of the committee;

Fifth, the committees be required to report meetings and progress quarterly, or as often as circumstances may make desirable, to the secretary of the Association;

Sixth, the president and editor be kept advised by the secretary from time to time of progress in committee work. . . . .

The interrelation of any national society with its local sections is a most important one. Much study is being given today by all of the national societies to the problem of determining the best manner for keeping the sections closely in touch with the work of the parent organization. To this end it is desirable to have all important section meetings attended by some member of the Executive Board of the main association. The work of the sections should in general be local in character. The broader problems, involving wide range in conditions, should be reserved for discussion before the parent association. It in turn owes the obligation to discriminate clearly between new live matter and the smaller problems of more local interest; and to reduce the amount of redundant matter in its journal, to a minimum.

Financial Matters

Present conditions demand that I call pointedly to your attention the obligation of the managers of the water-works of this country, both municipal and privately owned, to aid in giving the public service commissions or other regulatory bodies a just appreciation of the financial difficulties in which many water-works now find themselves, as a result of rapid advance in wages, cost of materials and standards of service, for some time past, acutely aggravated by present war conditions. Water-works properties have for years been less attractive for investment than the stable nature of their business should have made them, essentially because of inadequate return, or at least unattractive profit. The profit item has gradually been reduced, in many cases to the vanishing point, by the influences cited, coupled with the growing cost of litigation and proof of fundamental value, as is well known to you water-works men.

Now comes the added burden of high prices induced by war conditions, which is sweeping away depreciation allowances and reserves and resulting in a declining service. Men familiar with such matters view with deep anxiety the failure of regulating bodies to recognize the inevitable result of this condition and to govern their actions accordingly. Later on, the public will make felt its protest against a declining service, in no uncertain terms. Present inaction is as disadvantageous to the public as to the private interest. The way in which it is felt differs only in time, the ultimate inconvenience, annoyance and positive loss being common to both.

Everything Costs More

With wage increases of from 15% to 30% in the last few years, and advances in cast-iron pipe from $25 to $55 per ton, lead from 5c. to 10c., copper from 13c. to 30c., steel products more than 100%, so too coal, cement from $1.25 to $2.50 per barrel, and machinery not only doubled in value but impossible of prompt and reasonable delivery, it is clear that capital cannot be induced to extend the service without substantial relief of some sort.

Therefore, I say to you, join one another in presenting the actual facts convincingly to the authorities wherever occasion requires relief, that the public service may not be impaired through lack of knowledge on the part of the governing bodies. The position of these bodies or commissions is at best most difficult, particularly under such conditions as now prevail, and they are deserving of all the assistance that we can give them, as the problem is a vital one and essentially one of public education.

Wrestling with Filter Bottom Troubles at Minneapolis Plant

By LEWIS I. BIRDSALL
Superintendent of Water Filtration, Minneapolis

THE mechanical filter at Minneapolis had not been in service 60 days before breaks occurred in the Tobin-bronze strainer plates. At first the breaks were scattered, but they became so frequent that it was necessary to remove all the center strainer plates from all the filters. The brass-wire screen that had been bolted to the ridge blocks to hold the gravel down became such a nuisance at this time that it was taken out altogether and the depth of gravel increased to 13 in. with a new size, 1½ to 2 in., added. The filters have washed better without the screen.

Investigation showed that many of the center plates and a few side plates had failed. Most of the breaks, however, were in the center plates, which were supported by yokes from above the plates, whereas the side plates were held in place by U-bolts from below. It was thought therefore that possibly the design of the center plates was at fault, and F. W. Cappelen, city engineer, suggested reinforcing each sound center plate with ⅛-in. sheet brass riveted longitudinally along the center line of the plate. The broken center plates were replaced with medium brass plates made up as needed. Many of the reinforced plates cracked along the edge of the brass strip and had to be removed.

Tests of the tensile strength and bending of the Tobin bronze were made on strips cut from plates that had failed, but the tests seemed to show that the metal met the original specifications. Meanwhile the breaks continued, and it became difficult to keep enough filters in service to supply the city with water.

Strainer-Plate System Redesigned

A decision was made to redesign the strainer-plate system, making the plates heavier, increasing the size of the holes in the plates from $\frac{1}{16}$ to $\frac{3}{32}$ in. and reinforcing the plates with bronze ribs. Inquiry was made of various users of naval bronze, and all agreed that the best grade of Tobin bronze should be adequate for the city's needs. The plates and bolts were then ordered made according to plans and specifications rigidly drawn by the designing engineer and approved by the city engineer, Mr. Cappelen.

The new plates and bolts were properly installed in one filter unit, and the filter was placed in service. Breaks occurred, and upon investigation it was found that the bolts in the center had failed. A few of the plates also had cracked.

All bolts were then tested in tension by a dead-load of 800 lb. Bolts tested to failure in a testing machine straightened out at a load varying from 1420 to 1350 lb. Other bolts bent through 180° flat on themselves showed no fracture of the bent portion. The bolts tested to failure have a unit tensile strength varying from 71,000 to 100,000 lb. per sq.in. Carefully tested and inspected bolts and plates were then replaced in the filter, and the filter was put in service. Failures again occurred.

A new lot of bolts were then heated in a furnace to a cherry red, quenched in lukewarm water, tested to 600 lb. and put in place. They lasted about four weeks.

Strainer plates next began to fail. Laboratory tests were made to determine the effect of temperature changes upon the metal, also of electric currents and of the water in the filters. These tests seemed to have no effect whatever upon the metal, which appeared to be sound. The mercuric chloride test was applied, but without any result.

Annealing of Plates and Bolts Successful

The company which made the plates and bolts suggested that possibly the cold-working of the metal in making it up into plates and bolts might have caused a rearrangement of the molecules. It suggested annealing the metal. Therefore, enough plates and bolts to equip one filter were heated in a furnace to a cherry red for one hour, then removed and slowly cooled. These plates and bolts were then placed in a filter, and the filter was put in service. The results were very gratifying, no breaks occurring. The rest of the plates and bolts were then annealed in the same manner and, after inspection and removal of any cracked ones, were placed in the filters. Only a few scattered failures have since occurred.

The medium brass plates and bolts installed in the filters have shown no failures whatsoever. Monel-metal plates and bolts likewise used in one filter have shown no failures. All our troubles were confined to Tobin bronze.

The United States Bureau of Standards made an investigation of the molecular structure of plates and bolts that failed and likewise of similar material that had not failed. Their conclusions, based upon these investigations of naval-bronze failures elsewhere, are that the cold-working of the metal and too little attention paid to annealing cause considerable internal stresses, which are responsible for the above failures. It appears probable that hereafter monel metal will be used for strainer plates and bolts at the Minneapolis filtration plant.

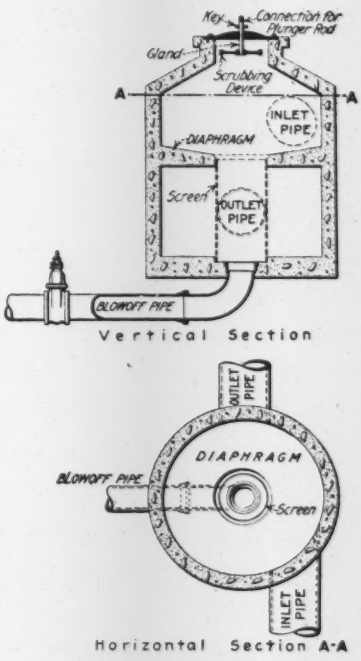
New Design of Screen Chamber

By JOHN H. LANCE
Hydraulic Engineer, Wilkes-Barre, Penn.

ALL stream, reservoir and lake supplies require careful screening before the water may be admitted to the distribution system. Among the bodies to be removed from the water are grass, leaves, sticks, bits of bark, and fish.

The customary method of removing these substances is to install either a screen affixed to the pipe or else two screens in series, one of which may be drawn up out of the water for cleaning while the other is in service. The former arrangement, which is applicable only to very small depths of water on the screen, is economy itself in first cost, but its use has not always proved so economical; as owing to any one of many causes the screen might not receive the necessary attention at the very time when it was most needed. The latter necessitates a considerable structure to hold the screens in place and house them while being cleaned, besides the trouble and expense of cleaning.

To obviate these and other difficulties the pressure screen chamber here described was designed. It consists essentially (see illustrations) of a vertical cylinder divided by a horizontal diaphragm into two compartments; the upper, or inlet, compartment has communication with the lower, or outlet, through a circular opening in the diaphragm and thence through the meshes of an open-ended cylindrical screen resting in the lower compartment, of a diameter nearly that of the opening. The lower end of the screen is concentric with the end of a blowoff pipe with a gate valve on it, normally closed. The inlet pipe enters the inlet compartment tangentially, while the outlet may leave in any direction relative to that of the inlet, preferably in a radial position. Any flow from the inlet pipe sets up a whirling motion in the water in the upper compartment. In passing through the screen cylinder it has a circumferential as well as a downward motion, which, owing to the passage of water through the meshes of the screen, diminishes as the bottom of the screen is approached. The result of this is to confine, largely, the foreign matter carried by the water to a central cone the base and height of which are approximately those of the screen. The upturned end of the blowoff pipe being made of nearly as great a diameter as the screen, this results in an accumulation of débris directly in the pipe. When blocking of the screen has progressed to a point at which there is a noticeable loss of head at the screen—as measured preferably by a mercury U-tube or a differential gage—the blowoff gate is opened; the head in the blowoff pipe is then reduced to zero, or nearly so, the hydraulic gradient from reservoir to screen chamber is increased, and the high velocity established is transmitted directly to the water passing diagonally downward over the face of the screen and out the blowoff pipe. Ordinarily, the cleaning of the screen is accomplished in about the time that it takes to open and close the blowoff gate. If it is desired to maintain a considerable continuous flow through the outlet pipe, the blowoff gate need not be opened wide, in which case the operation will require a longer time. Under no conditions is an appreciable amount of water wasted.



REINFORCED-CONCRETE PRESSURE SCREEN CHAMBER

Hollow Segmental Brush

Also incorporated in the design is a hollow segmental brush, for use in cases when the screen does not get attention for such long periods that a deposit of small fish is not readily removed by the flowing water. For the intake pipes of pumping stations the devices are best set

in batteries of two, so arranged that one can be put in service while the other is being cleaned. In this case the cleaning is preferably done by jets of high-pressure water directed downward from the edge of the diaphragm across the screen. Where electric power is available, the use of proper contact devices at the point of measurement of the loss of head at the screen will make the entire screening operation automatic, both for gravity and pumping supplies.

For use with a gravity water-supply the devices have been found to operate most successfully between the heads of 40 and 60 ft., though there is no valid objection to their use at other heads, under certain conditions. The screen chambers are made entirely of reinforced concrete with the exception of the manhole cover, which is of cast iron.

The principle of pressure screening, from which the design was developed, was first suggested by O. M. Lance, general manager of the Spring Brook Water-Supply Co. The operation of the screen chambers has been found to be so economical and efficient that they have been adopted as a standard by that company. As convenient, all 20 of its supply lines will be equipped with the new device, and the old sliding screens will be removed, only bar screens being left in place.

The application of this development is quite wide and covers a variety of uses, such as meters, fish traps and sewage-sludge screens. It is covered by letters patent.

Water-Supply Standards and Their Improvement

By WILLIAM J. ORCHARD

Sanitary Engineer, Wallace and Tiernan Co., New York City

A RESUME of legislation and the regulations of supervising health bodies indicates that the only definite technical water-supply standard that has officially been promulgated is that of the Secretary of the Treasury, under date of Oct. 21, 1914, it being "a bacteriological standard of purity for drinking water supplied to the public by common carriers in interstate commerce."

From information available it would appear that none of the state health departments have officially promulgated standards of purity, either bacteriological or chemical. In many states, legislation exists prohibiting pollution of public water-supplies or the sources from which they are obtained. A few of the state health departments recognize the standards of the Treasury Department and aim to have all water-supplies conform to these limits. Other state departments of health have unofficial standards that are used as a means of guidance in interpretation of water analyses.

Reports from 31 Departments

Reports received from 31 state health departments indicate that 13 states have laws protecting water-supplies, but have not adopted any minimum chemical or bacteriological standards. Two states have laws protecting water-supplies and have unofficially adopted United States Treasury standards. Nine states have laws protecting water-supplies and have adopted tentative unofficial standards, while eight states have neither laws nor standards.

Unofficial or tentative standards that have been adopted by some of the state departments of health are of interest. A few examples are enumerated:

Minnesota—The Minnesota State Board of Health has not set any arbitrary standard for the purity of water. In interpretation of results a water is not considered to be of good sanitary quality unless the bacteriological count for four days at 20° C. is less than 100 per c.c., and B. coli absent in 100-c.c. samples. This standard is subject to qualification under certain conditions. The Minnesota State Board of Health will not report on any water-supply unless a thorough field investigation has been undertaken anl unless samples have been collected by its own representatives.

Alabama—The Alabama Board of Health recognizes the standards adopted by the Treasury Department, allowing, however, a bacteriological count of 300 per c.c. after 24 hours' incubation at 37° Centigrade.

Virginia—The State Board of Health of Virginia has not adopted any standards and in an interpretation of analyses is largely governed by the particular conditions surrounding the source of supply; and even though a water derived from a protected watershed on which there is no habitation might show coli in 1-c.c. and 10-c.c. samples, unless human contamination could be shown, the water-supply might be considered good. For the information of local authorities, however, the Virginia State Board of Health indicates on its standard report forms the significance of bacteriological counts and B. coli interpretations, differentiating bad, suspicious and good supplies, as follows:

> Where colon bacilli are found in quantities of 1 c.c. of water, the sample is dangerous and is reported bad, regardless of the number of other bacteria found in the sample.
>
> Where colon bacilli are found in 10 c.c. or 20 c.c. of water and the number of other bacteria is large, the sample is regarded as dangerous and is reported bad.
>
> Where colon bacilli are found in 10 c.c. or 20 c.c. of water and the number of other bacteria is small (less than 500 per c.c.), the specimen is classed as suspicious.
>
> Where colon bacilli are not found in samples and where bacteria are less than 500 per c.c., the sample is reported good.

Maryland Recommends Effluent Standards

Maryland—The State Department of Health of Maryland has not established any standards or limits on the quality of public water-supplies, but certain standards have been recommended for filtration plants. These standards are quite novel and are based on the coefficient of efficiency, which is defined as "the ratio of the logarithm of raw-water count at 20° C. to the logarithm of the plant effluent count." For the removal of colon the standards are based on a so-called "standard hygienic efficiency," which is defined as "the sum of the percentages obtained by allowing a value of 20% to each successive step in the colon removal."

Montana—The Montana Department of Health has adopted tentative chemical standards for the hygienic purity of waters, applicable to restricted areas in the state; and as a rule, only supplies that show no B. coli in 10 c.c. are recommended for public consumption.

California—The California Bureau of Sanitary Engineering considers a supply in which B. coli cannot be confirmed in 10 c.c., by the latest laboratory methods, as safe. The occasional occurrence of B. coli in the same quantity is not considered seriously, but their presence in 10 c.c. continuously, or in less than that amount occasionally, is not considered favorably. Condemnation is usually reserved for a field inspection, to determine, if possible, what portion of the B. coli are of human origin.

Iowa—Iowa presents an interesting situation; chemical standards adopted for the waters of the state several years ago have been abandoned, following the collection of information showing their inadequacy.

A résumé of reports received from over 30 state health departments shows the varied interpretations placed on bacteriological analyses and the relative importance given to sanitary surveys of watersheds in conjunction with analyses.

The United States Treasury Standards

If the standards of the United States Treasury Department must apply to all water-supplies used in interstate traffic, and if, as experience has clearly shown, supplies used by railroads can conform to Treasury standards, the interesting contention is presented that all public water-supplies should conform at least to this standard. If all supplies do not measure up to this standard, the regulation works an injustice on the few supplies that do comply and does not accomplish a general improvement in the water-supplies of the country, as might otherwise be the case.

Although the United States Treasury standards are high, as compared to many water-supplies in this country, and although a large number of waters of our bigger and better-known cities would not at all times conform to the Treasury standards, it is not high as compared to the standards existing in European countries and Great Britain.

Many English water-works men contend that the total bacteriological content after 24 hours' incubation at 37° C. should not be more than 50 per c.c. and that coli should be absent in 100-c.c. quantities after 72 hours' incubation at 37° C.; and some even go so far as to aim to have colon absent in 200 c.c. after 72 hours' incubation at 37° Centigrade.

Improving the Water-Supply Standard

In advocating the adoption of minimum bacteriological standards of water, the object in view would be to improve the poorer supplies and to establish a guide by which non-technical water-works men could appraise their supplies; to establish standards not so much as an arbitrary means of appraisal as an incentive to secure better water-supplies.

It is therefore suggested that consideration be given to the appointment of a subcommittee of the American Water-Works Association to determine the practicability of adopting standards similar to the United States Treasury standards for all water-works, whether they are used for interstate traffic or not.

Furthermore, with the object of creating a demand for pure water on the part of the consumer, thus offsetting the deleterious influence of the careless water vender, and to support the technical water-works man in the promulgation of higher standards of water-supplies, this suggestion is offered: That the association appoint a committee to consider the feasibility of a joint board to consist of four members, one each appointed by the presidents of the American Water-Works Association, the New England Water-Works Association, the American Public Health Association and the Water-Works Manufacturers Association—these four men to appoint a publicity, or press, agent, who might well be one of the secretaries or editors of those associations, whose sole duty would be to spread the propaganda of better water-supplies. There are many problems presented—the cost of broadcast publicity at first would be prohibitive, but intensive advertising campaigns could easily be conducted in certain localities.

Subcommittees could be appointed to confer with various state departments of health, covering publicity in their territory. Other subcommittees could be appointed in some states, if necessary, to endeavor to secure legislative enactment to protect water-supplies and create an interest in the subject. Arrangements could be made with some of the larger private water companies to advertise steps they have taken to protect their supplies along the lines undertaken by the Indianapolis Water Co. Other subcommittees could make arrangements with the boards of education, libraries and exhibits.

Treasury Department Standard for Drinking Water

By H. P. LETTON

Sanitary Engineer, United States Public Health Service

SHORTLY after the promulgation of the interstate quarantine regulations requiring interstate common carriers to furnish pure drinking water for passengers, it became necessary to establish a standard as a basis upon which to formulate an opinion as to the safety of any given water. The Secretary of the Treasury in January, 1913, appointed a committee of 15 eminent bacteriologists and sanitarians to recommend such a standard.

After somewhat over a year's study the committee made recommendations that were adopted by the secretary and promulgated as part of the quarantine regulations on Oct. 31, 1914. The committee was very explicit in pointing out that the recommended standard was not a "standard of purity," but was, on the contrary, a "standard of permissible impurities."

What the Standard Was

Briefly, the standard requires that not more than 100 colonies per 1 c.c. shall develop on agar incubated 24 hours at 37° C. and that there shall not be more than two B. coli per 100 c.c. when the water is tested in accordance with the recommended procedure.

This was the first attempt made in this country to establish a general standard for the bacterial content of drinking water, although such standards have been in use in other countries for many years. Because of our peculiar governmental system each state has been a law unto itself, and a water that would be considered of satisfactory quality in one state might fail to pass the requirements of an adjoining one.

There is absolutely no question that the establishment of the Treasury Department standard has been an impelling force in improving the quality of public water-supplies throughout the country. As far as the writer knows, there is only one state, Minnesota, which before the promulgation of this standard required that a public water-supply should be free of B. coli in as large a quantity as 50 c.c. Minnesota has required and does now require that B. coli be absent in 100 cubic centimeters.

In order to ascertain whether it was feasible to utilize the Federal standard in the manner presupposed by the commission, several hundred samples were collected from railroad cars within the sanitary district of the Great Lakes. At the time the samples were collected infor-

mation was gathered regarding the point or points where the water was originally obtained, as well as the length of time that had elapsed since the coolers were filled. In few cases could information of any reliability be obtained. The analyses of the water also gave little of value, inasmuch as certain samples, supposedly from the same source of supply, taken on different days, gave widely divergent results. Moreover, in case a sample failed to meet the requirement of the standard, there was no way of knowing whether the impurities were present in the source of supply or were introduced in the process of filling the coolers. As a result of these analyses it was plainly evident that, in order to bring about any permanent and beneficial results from the enforcement of the standard, reliable and accurate data regarding the source of supply must be obtained.

Inasmuch as this would require a sanitary survey of each source, and since analyses of shipped samples are not as reliable as those examined immediately after collection, it was deemed advisable to carry a laboratory into the field. A portable laboratory was therefore devised and used for about two months. The results of the field-work indicated that it was the proper method of handling the situation, but because of certain difficulties with the portable laboratory its use was discontinued and a laboratory car designed. This car, which was built by the Pullman Co., has now been on the road for about two months and has demonstrated its usefulness in handling the problem.

Sanitary Surveys Necessary

After having made some 30 sanitary surveys of water-supplies used by railroads, it became more and more evident that such surveys were absolutely necessary to correlate the analyses, in order that an opinion could be formed as to the safety of any given water. In order to make the surveys mandatory, the interstate quarantine regulations were amended on Feb. 12, 1917, so that they now require that the water shall not only conform to the bacteriological standard, but shall not be from a supply that is exposed to contamination.

The matter of enforcing these regulations in the sanitary district of the Great Lakes has been from the start carried on with the idea of not only benefiting directly the passengers on railroad trains, but benefiting indirectly the much greater number of people using the same supplies in towns.

When the sanitary survey and analysis show that a supply is contaminated or is exposed to contamination, a letter is prepared to the municipality or private water company, as the case may be, in which the conditions are outlined and suggestions made for betterments. In many cases these recommendations have been adopted, usually because the municipalities are aware that, unless corrective measures are adopted, the railroads will not be permitted to use the supply.

Reasonable Standards

To return to the question of the B. coli requirements of the standard, over 100 investigations have been made of water-supplies used by railroads in Illinois and Michigan. These supplies have been of all types: Shallow wells, deep wells and surface water, treated and untreated. The filtration plants, ranging in size from 15,000,000 to 1,000,000 gal. per day, all produced a water well within the bacteriological requirements. All the disinfection plants, most of which used liquid chlorine, produced a satisfactory water. The only supplies failing to meet the standard were untreated supplies and a few groundwater supplies. In every one of the latter cases, however, the sanitary survey had shown some point of possible contamination.

Only two supplies failed to meet the total count requirement, and in each of these instances the water had been stored in large reservoirs that had not been cleaned for a considerable period. The agar count, as a general rule, was less than 10 per c.c. The fact that most of these analyses were made during the winter months undoubtedly had some influence on the low counts. These data are sufficient to convince the writer that it is possible for any public water-supply to meet the requirements of the Treasury Department standard without undue expense.

What the Studies Show

From the foregoing statements the following conclusions can be derived:

1. The requirement of the standard regarding total count is very lenient. It could be reduced more than half without eliminating any but an extremely small percentage of supplies that would otherwise pass the requirements.

2. The limit of permissible B. coli content is not too low. A properly operated filtration plant will produce a better water than the standard requires. A disinfection plant that will not produce a water within the limits should be considered as only a temporary protection, and filtration should be adopted. An untreated ground supply containing more B. coli than the standard permits is being contaminated by outside sources that should be discovered and eliminated.

3. Sanitary surveys of the sources of supply are absolutely essential to correlate the bacteriological analyses.

4. The Treasury Department standard has been of immeasurable value, not only by causing carriers to furnish a safe drinking water for passengers, but more so by the establishment of a high criterion for judging the quality of public water-supplies throughout the United States.

Reinforced Concrete Withstands Explosion

Little regarding the recent huge explosion in the east end of London has filtered through the censor's hands, but the New York *Evening Post* has rescued the following highly untechnical, but nevertheless interesting, paragraph from one reporter's account of the damage: "The triumph of ferro-concrete construction is the most striking feature of the catastrophe. Not only have such structures within the explosion area withstood the effect of the air wave, but they came through the ordeal of fire successfully. The metallic rods and laths within the concrete enabled the buildings to give slightly to the air wave when it struck the buildings; the windows caved in. The reverberating air entered and, expanding, passed through the opposite windows, thereby helping to straighten up the main structure again, although fire was left behind. Brick structures collapsed ignominiously, being pulled inward by the floor and roof joists and girders."

Growth of Filter Sand at Three Water-Softening Plants

History and Experiments at Columbus, Ohio, Grand Rapids, Mich., and Erie, Penn., Given in a Series of Three Articles

Incrustation of filter sand passing water treated with lime for softening purposes largely increases the effective size and reduces the uniformity coefficient. The sand growth and the loss of sand in washing result in an eighth of the original sand ultimately filling the filter tank to its original sand surface level.

Part III—Eight Years' Experience at McKeesport

By EDWARD C. TRAX
Chemical Engineer, Water-Softening and Filtration Plant, McKeesport, Penn.

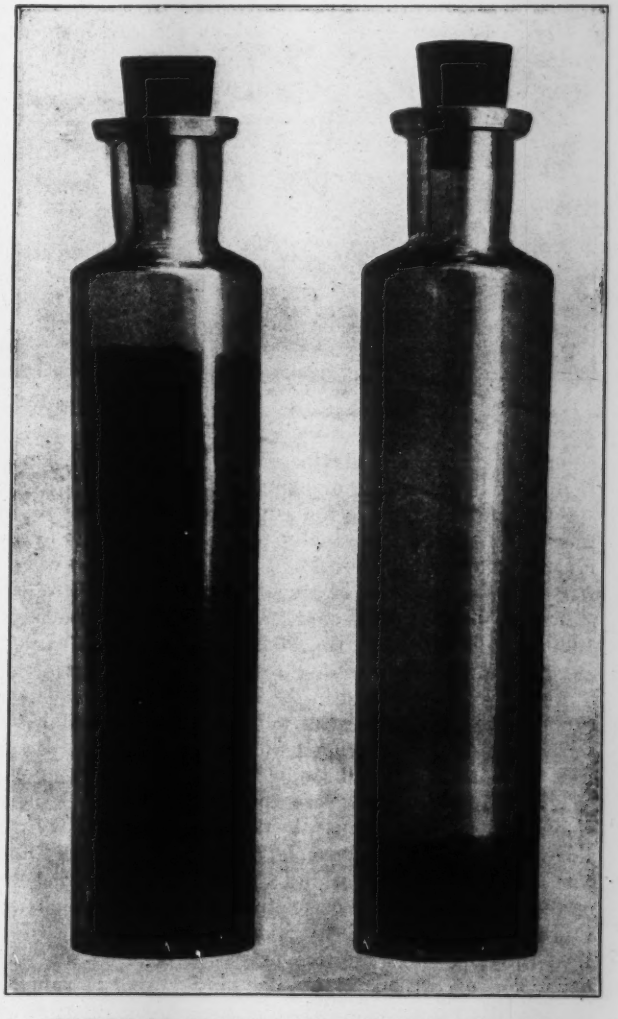
ONE of the results of the treatment of a natural water with lime, or lime and soda ash, is the formation of a precipitate of calcium carbonate which is very slightly soluble in water. The precipitate settles out more or less completely on standing, depending largely upon the time and the presence of other chemical precipitates, such as the hydrates of aluminum, iron and magnesium. It has been observed that, where sand filters are operated in connection with water-purification plants in which calcium carbonate is precipitated from the water, the filter sand becomes incrusted with a calcareous deposit; the sand "grows," or increases in volume, due to the sand grains becoming coated with this deposit. The incrustation that followed the use of lime in some filtration plants in Illinois was commented upon several years ago. (E. Bartow and C. E. Millar, "Extent and Composition of the Incrustation on Some Filter Sands," *Journal* of Industrial and Engineering Chemistry, February 1911.) It was noted in connection with these plants that the increased size of the sand grains resulted in the lowering of the bacterial efficiency of the filters.

Residual Carbonates Cause Deposition

It appears that this deposition is due to the residual carbonates, principally calcium carbonate, in the water after passing through the settling basins. This may be partly in suspension, but it is believed to be principally present in supersaturation, and the action is thought to be similar to that which takes place when a supersaturated solution deposits crystals about a solid nucleus.

At McKeesport the softened water after 15 to 20 hours' settling is passed through rapid sand filters. The Youghiogheny River water, which until last summer constituted the raw water-supply, contains large amounts of iron and aluminum sulphates and free sulphuric acid. Upon the addition of lime and soda ash this forms an excessive coagulation and results in rapid settling of the chemical precipitates. Ordinarily the water has come to the filters perfectly clear and in an entirely satisfactory bacterial condition. The burden on the filters has been very light, and the periods between washings have been exceptionally long. The "growing" of the sand was first noticed with considerable alarm, and it was thought that the sand would soon be rendered worthless. While this coarsening of the sand doubtless lessens the efficiency of a filter for bacterial removal, there was no reduction in the efficiency of the purification process as a whole at McKeesport, because the bacteria and turbidity were satisfactorily removed in the settling basins by the heavy coagulation and the germicidal action of the lime treatment.

The sand originally placed in the filters in October, 1908, was in continuous use until October, 1916, when it was removed and replaced with new sand on account of a change in the raw water-supply from the Youghiogheny to the Monongahela River. The water in the Monongahela River above McKeesport requires little softening, but the bacterial condition is much worse than the Youghiogheny, chiefly because there is less acid-iron waste pres-



GROWTH OF FILTER SAND, McKEESPORT, PENN.
The nearly full bottle shows the sand after eight years' service, and the other bottle shows the same amount of sand after having been cleaned with acid

ent to produce a germicidal effect. A comparison of the B. coli tests for a period of six years indicates that the pollution of the Youghiogheny is double that of the Monongahela, the per cent. positive presumptive tests for B. coli in 1-c.c. samples being 35 as compared with 70.

The purification of this supply places an additional burden on the filters, and for this reason it was considered advisable to replace the incrusted sand with new sand. The sand was removed from the filters with a sand ejector. No lumps were found, with the exception that the 4 or 5 in. of sand just above the gravel was somewhat cemented together. It is believed that the tendency of the sand to cement together and form large lumps was prevented by the very effective air wash given the filters at each washing. The gravel was rather firmly cemented together, but not incrusted except at the points of contact. After the lumps were broken up, the gravel was found to be in good condition and was replaced in the beds.

The brass air laterals were clogged to some extent by deposits around the slots; they were removed and pickled in hydrochloric acid just long enough to remove the carbonate deposits and were then replaced. The strainer system was somewhat incrusted, some of the holes in nearly every strainer being closed by the carbonate deposits, although no strainer was found with all the holes clogged. The deposit was easily dissolved with hydrochloric acid, and the strainers were put in good condition with little trouble or expense.

After eight years' use the sand remaining in the filters was 16.9% of that originally put in, the deposit or incrustation accounting for 83.1%. The increase by weight was 491%. Analysis of the deposit showed: Insoluble material, 0.67%; iron oxide, 0.81%; aluminum oxide, 1.60%; calcium carbonate, 93.26%; magnesium carbonate, 3.90%.

As the volume of sand in the filters increased, some was carried away with the wash water each time a filter was washed; and the additional volume of sand was therefore disposed of without trouble or expense.

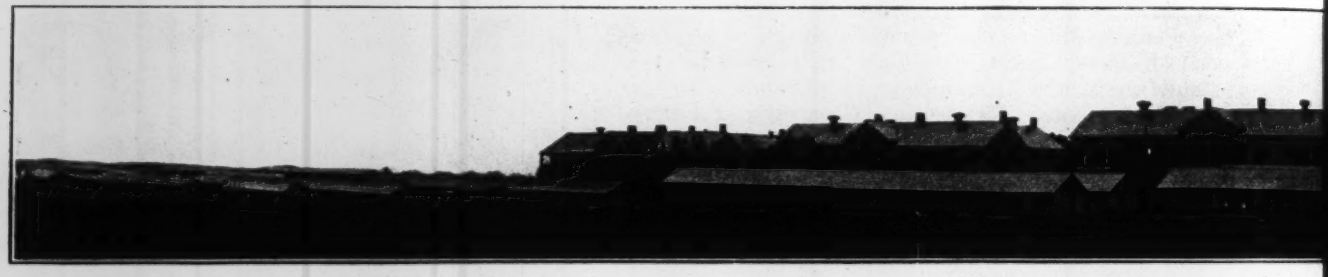
While this sand was very coarse and doubtless inefficient for bacterial removal, the service given is considered entirely satisfactory. The effluent from the filters was always perfectly clear and sparkling, and the efficiency of the plant as a whole excellent. Except for the change in raw water-supply the sand could have been used at least three or four years longer. It is believed that this deposition of carbonates on the sand grains is valuable in preventing the accumulation of scale in the distribution system, a trouble often experienced in pipe lines leading from commercial water softeners. The incrustation can be prevented by carbonating the softened water, as was done in connection with the water-softening process in Winnipeg a number of years ago. This improves the taste, but adds to the cost and to the corrosive action of the water on the pipe system. The experience at McKeesport does not indicate that increased settling capacity within reasonable limits would be effective in preventing this action.

Compared with the benefits derived from water-softening incrustation or filter-sand growth, this does not appear to be a very serious difficulty; and with reference to new plants it seems that the matter can be taken care of by the engineer in depreciation calculations by figuring at 10 to 12 years the life of filter sand used under these conditions.

Erect Camp Buildings for 2400 Men in Two Weeks

Seven Days After Award Contractor Had Put Up Million Feet of Lumber in Training Quarters at Fort Myer, Va.

THAT the methods of modern skyscraper and reinforced-concrete building construction do not apply to erecting a temporary camp has been disproved again by a New York contracting firm, which has just completed in less than two weeks quarters for 2400 men, who will be called in the near future to the Reserve Officers' Training Camp at Fort Myer, Va.



WORK ON CAMP REQUIRING A MILLION FEET OF LUMBER STARTED APR. 27, ONE WEEK BEFORE THIS ASSEMBLED WITHOUT DELAYING OTHER WORK

Work Started Within Eighteen Hours

An order for the construction of this camp was received unexpectedly on the afternoon of Thursday, Apr. 26, by the George A. Fuller Co. Work was begun Friday morning, and the following Friday, on which day the photograph shown was taken, most of the buildings had been erected, a large part of them had been glazed and some of them had been finished. During the following week the construction was entirely completed. Each of the buildings will house a company of 158 men. In addition to the barracks, a large mess hall and kitchen and a building with lavatory facilities were constructed.

Materials Assembled from Near By

A large proportion of the gangs of carpenters and laborers needed were withdrawn from a dozen or more big contracts under way within a short radius of Washington, and rushed to the camp site. The million feet of lumber, and the sash and trim required, were bought on short notice from Washington yards and sent across

the river in motor trucks. The hardware was also obtained locally, but the plumbing was bought wherever the contractor's purchasing department could locate stock for immediate shipment, and sent to the work by express.

Construction started at the right-hand side of the photograph, and progressed to the left. The first labor gang dug post holes, and was followed by another setting foundation posts. These were followed in turn by the carpenters, the men placing the sand-and-tar composite roofing, the glazing and other work. A portable sawmill, run by gasoline engine, was sent to the work and moved along in three or four set-ups from one end of the camp to the other as the carpenter work progressed. In this way all the cutting off and framing was done by power, the carpenter labor being kept busy at erection. No painting was required.

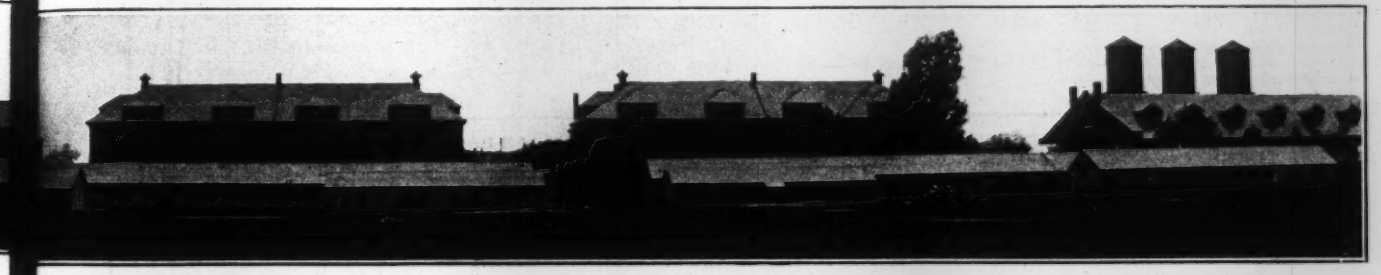
Work was carried out under the general direction of Jas. Baird, vice president of the George A. Fuller Co., with J. W. Cramer as superintendent.

Offer Divers Solutions of Canada's Railway Problem

Majority and Minority of Royal Commission Favor Indirect Public and Private Operation Respectively—Third Distinctive Plan Proposed by Outside Engineer

A COMMON starting point is used in the various solutions offered for Canada's complex railroad problem in the recognition that the extravagant construction programs of the past, and the lavish government loans, guarantees and gifts, must be stopped; that two but not three transcontinental lines are desirable; that the strength of the Grand Trunk Ry. in the East and the Canadian Northern Ry. in the West should be utilized, and that the strength of the Canadian Pacific Ry. should remain unimpaired. Two distinctive plans are proposed in the respective majority and minority reports, just made public, of the Royal Commission created to study the situation. Sir Henry L. Drayton and W. M. Acworth recommend the creation of a board of public trustees, incorporated as the Dominion Railway Co., to take over the ownership of the Grand Trunk, Grand Trunk Pacific and Canadian Northern railways and operate them, together with the Government-owned National Transcontinental and Intercolonial railways, as one united system. A. H. Smith, chairman and the remaining member of the commission, would retain the present private control of the Grand Trunk and Canadian Northern systems, but would eliminate destructive competition between them by giving the former the eastern territory and the latter the western, each to take over under lease the unprofitable lines of the other in its territory, and a possible third company to take over the intermediate lines between North Bay and Winnipeg.

To these two plans should be added a third, presented last January before the Canadian Society of Civil Engineers by W. F. Tye, formerly chief engineer of the Canadian Pacific. Mr. Tye would carry Mr. Smith's plan farther, to a consolidation of all but the Canadian Pacific into a single new private company.



PHOTOGRAPH WAS TAKEN, AND PROGRESSED FROM RIGHT TO LEFT—MATERIALS AND MEN WERE OF THE CONTRACTOR IN THE SAME TERRITORY

Those familiar with Canada's railway history are aware of the extravagant railroad construction that has been going on in the Dominion for the last fifteen years, countenanced and encouraged by the Government through loans, guarantees and outright gifts. In fact, the greatest extravagance of all appears to have been the Government-built National Transcontinental Railway.

Prior to this period the Canadian Pacific had built up a strong system from the Atlantic to the Pacific, while the Grand Trunk also had a strong position in eastern Canada, reaching west, however, only to North Bay, Lake Huron and Chicago. West of Winnipeg, the Canadian Northern had begun its extensive development. In the extreme east was the Government-owned Intercolonial, which had never of itself been a successful venture, but which was justified by many because of its service in linking the provinces together.

Grand Trunk as a Transcontinental Line

In 1903 a start was made for a transcontinental line for the Grand Trunk, from Moncton to Prince Rupert. The line west of Winnipeg was to be built by the Grand Trunk Pacific with large Government assistance, the entire capital stock of the Grand Trunk Pacific being held by the Grand Trunk. The line east of Winnipeg, which became known as the National Transcontinental, was to be built by the Government and leased to the Grand Trunk Pacific. (The original proposal of the Grand Trunk was for a line only from Prince Rupert to North Bay, connecting there with the Grand Trunk, but the Government elected to carry the line all the way eastward to Moncton.)

The lines were built, at great cost. Subsequently the Grand Trunk declared itself unable to fulfill its obliga-

tions with respect to the Grand Trunk Pacific, and it has asked the Government to take the latter over, repaying to the Grand Trunk its outlay; while the Grand Trunk flatly refused to take over the National Transcontinental, alleging that its cost had been excessive and that it was not completed. The Government, therefore, was forced to undertake the operation of the National Transcontinental. A commission created to investigate the Grand Trunk charges reported that the cost of the National Transcontinental had, in truth, been scandalously high.

Canadian Northern's Career

Meanwhile, the Canadian Northern had also entered the field as a transcontinental line, building west to Vancouver and east to Montreal. In spite, however, of a large amount of public aid, this company also found itself unable to meet its obligations, and in 1914 appealed to the Government for extensive help. "At present," to quote from the majority report of the Royal Commission, "the company is living from hand to mouth, and is nominally *borrowing from the Government to pay interest on the Government's own loans.*"

The present situation seems to be that while both the Grand Trunk and the Canadian Northern systems have overwhelming indebtedness, on which they cannot meet the interest, neither is equipped to compete with the Canadian Pacific as a transcontinental line. The Grand Trunk is strong in the East but lacks feeders in the West, while the opposite is true of the Canadian Northern; and if they are to remain as separate systems each must build extensively into the strong territory of the other—and even then, the competition with the Canadian Pacific would be keen. The National Transcontinental, as well as the Intercolonial, is on the Government's hands, as it cannot earn its excessive fixed charges and does not interest private capital. Of all Canada's trunk lines, only the Canadian Pacific is in a very prosperous condition. And the Royal Commission was created for the purpose of seeking a way out of the dilemma.

Majority Plan of Royal Commission

The plan recommended by Sir Henry Drayton and Mr. Acworth is based upon their conviction that the Grand Trunk cannot be operated satisfactorily from England, where its ownership now lies; that it has no just claim to relief from the burden of the Grand Trunk Pacific, and that the Canadian Northern, having been financed largely by the public and being dependent upon the public for further capital, should be under the control of the public. The commissioners do not advocate Government operation as generally desirable; in fact, they point out objections, some of which will be mentioned later, to Government operation in Canada. Because, however, they feel that the roads in question should be under one management, and because they see no way to organize new companies to take the place of the old, the commissioners hold that the only possible successor is a public authority. They contend that such a board as they propose would keep the roads out of politics.

Formal Recommendations

The formal recommendations are:

1. That a board of trustees be constituted by act of Parliament and incorporated as "The Dominion Railway Company."

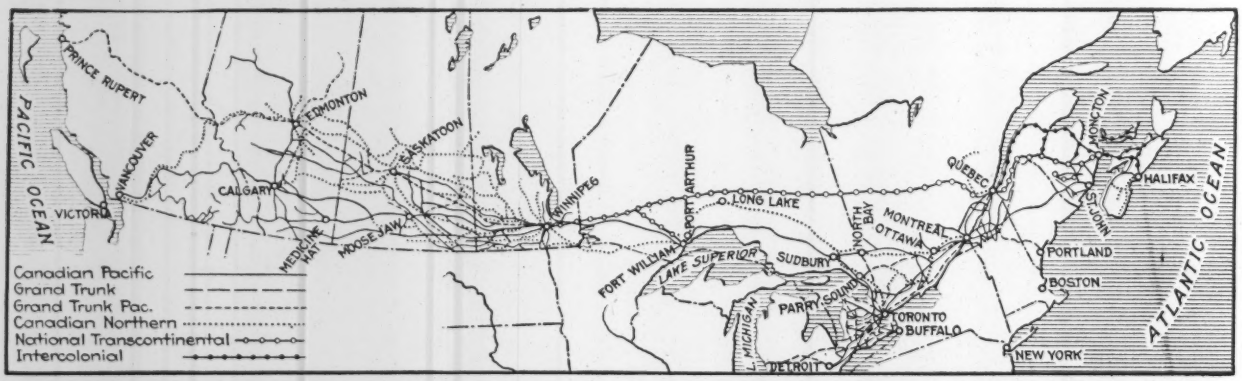


FIG. 1. CANADA HAS AT PRESENT SIX PRINCIPAL RAILROADS—THE CANADIAN PACIFIC, GRAND TRUNK, GRAND TRUNK PACIFIC, CANADIAN NORTHERN, NATIONAL TRANSCONTINENTAL AND THE INTERCOLONIAL

2. That the ownership of the Canadian Northern, Grand Trunk, and Grand Trunk Pacific railways be vested in this company.

3. That the Government assume responsibility to the company for the interest on the existing securities of these undertakings.

4. That the Intercolonial and National Transcontinental railways be also handed over by the Government to the company.

5. That the whole of these railways, the Canadian Northern, Grand Trunk, Grand Trunk Pacific, Intercolonial, and National Transcontinental be operated by the company as one united system.

Make-Up of Board

The trustees would be five in number. Three would be men of railway experience. One of the remaining two should be selected on the ground of business and financial experience and the other as specially possessing the confidence of railway employees. Appointment should be for a fixed period of seven years. Every trustee should be eligible for renomination and reappointment.

Vacancies in the case of railway members should be filled by appointment by the Governor-General in Council, on the nomination of the majority of the remaining trustees; and in the case of other members, by appointment from a list of three names, similarly nominated.

Subject to the power of the Government to refuse to confirm a nomination, it is recommended that the board

of trustees be a permanent self-perpetuating body. The majority report attaches great importance to this point, and mentions that the experiences of the older states of Australia, where short-term commissioners were under the direct control of a minister of railways, responsible to Parliament, were unsatisfactory. The commissioners are firmly convinced that railways are not a proper subject for direct Parliamentary control, and that only when the management is protected from the pressure of special interests can a railway be operated in the interests of the public as a whole. At the same time, because the non-political body would be "neither infallible nor impeccable," it is proposed to give the Board of Railway Commissioners the same full judicial authority over all its actions as the board at present has over private railway companies.

Transfer of Stocks

Under the majority plan all stocks of the existing companies would be transferred to the Board of Trustees.

No payment would be made for the stock of the Grand Trunk Pacific, except for the shares not held by the Grand Trunk.

The $40,000,000 common stock of the Canadian Northern vested in the Canadian Government would be assigned to the trustees, and also, on a basis determined by arbitration, the $60,000,000 still remaining in the hands of private persons. The commissioners hold that the Canadian Northern stockholders have no claim to compensation, but that it could well be taken into consideration that their unreasoning optimism was no greater than that of almost the whole population of Canada, and that the company has done much to develop the prairie provinces with lines well located, economically constructed and valuable for public service. They think, therefore, that the Canadian Northern stockholders could equitably be permitted to retain a moderate part of their holdings, and that a board of arbitrators should be empowered to decide what proportion they could retain and what proportion of the earnings of the Dominion Railway Company could fairly be regarded as attributable to the Canadian Northern lines.

Annuity for Grand Trunk

With respect to the Grand Trunk the commissioners think the situation is quite different. Whereas the Canadian Northern has built its lines economically and held to a moderate capitalization with no reward to its stockholders in the shape of dividends, the Grand Trunk is heavily capitalized, is poorly maintained, and has always paid dividends on certain classes of stock, even though they were not earned. The commissioners would take into consideration the fact that in the early days, with but small Government assistance, and in competition with the railways of the United States, the Grand Trunk stockholders built up the first Canadian railway system, and that in later times the company had further to meet the competition of heavily subsidized Canadian rivals. They feel that on condition of the surrender by the company of its entire share capital, the trustees should grant a certain annuity, charged as a working expense on the whole undertaking of the Dominion Railway Co., the amount at first to be a substantial percentage of $3,600,000, the average dividend payment for the last ten years, and to be increased 40 or 50% after seven years.

At the same time, because the company has five different classes of stockholders, the rights of which differ widely and can hardly be determined, the commissioners would have the annuity paid to the company as a whole, the directors of the company to assume the responsibility of preparing a scheme of equitable apportionment.

At the start the company would incur an annual deficit of about $12,500,000 per year. The commissioners believe, however, that with Canada continuing to progress at a normal rate, the growth of traffic and income would make the company solvent in six or seven years. The commissioners would make the Act require the board to operate its system on a commercial basis, and make no general reduction in rates until interest at a reasonable rate was earned on the whole $276,000,000 capital value of the undertaking.

Objections to Direct Government Operation

These are extracts from the commisioners' objections to direct Government operation:

> We know no country in the world where a democratic state owns and operates its railways, in which politics have not injuriously affected the management of the railways, and the railways have not had an injurious influence on politics. We do not think Government ownership of the Canadian railways would tend to a reduction of rates, but rather, in the contrary direction. . . .
>
> There are several reasons peculiar to Canadian conditions why state ownership and operation should be avoided. We think that if the state took over and undertook to operate the Grand Trunk, the Grand Trunk Pacific and the Canadian Northern, it would be morally bound to offer to purchase the Canadian Pacific also. This company is in a strong financial position; . . . its purchase would be a costly matter; and it does not ask to be purchased nor to be helped in any other way. The company is admittedly progressive and gives a good public service. . . . But the Canadian Pacific is exposed throughout its whole territory to the competition of either one or both of the other systems.
>
> So long as that competition is in the hands of other organizations, also having to earn the interest on their bonds and striving to earn a dividend on their stocks, the Canadian Pacific has no cause for complaint. But competition with railways operated by the Government stands on an entirely different footing. It would be at any time possible for the Government deliberately to adopt a policy to lower rates, . . . making up the deficiency out of general taxation. The Canadian Pacific would be absolutely forced to follow any rate reduction made by the Government railways on pain of losing the business entirely.
>
> Another strong argument against Government operation is to be found in the fact that the three Canadian companies among them either own, lease or control no less than 7000 miles of railways situated in the United States. . . . It is clearly impossible that the Dominion Government should be subjected, not only to the regulating authority of the Interstate Commerce Commission and the several state railway commissions of the United States, but also to the police regulations of all the states which these lines enter.

Other courses that have been proposed are discussed briefly in the majority report. Receiverships are rejected because the commissioners think the Government is responsible morally for the interest on bonds and debentures of the companies, especially those held outside of Canada. Transfer of all of the other companies to the Canadian Pacific is objected to because it would eliminate competition. As to the forming of a new commercial company to handle the three systems as one, the commissioners hold that the capital could not be raised in Canada and that it is undesirable to have Canadian railways under other than Canadian management.

Mr. Smith's Plan

Mr. Smith's objection to the majority recommendation is mainly that to him it is little different from government ownership or operation. He is unable to see by

what means one Parliament can bind its successor to a given policy, especially in so simple a matter as changing the organization of a government board. He states that the plan would add about $1,000,000,000 to the direct debt of Canada, and that "judging from the experience Canada has had with its Government railways, it is fair to assume that this would remain a permanent burden." Whereas, operated by private companies, he thinks the interest could ultimately be borne by the companies without recourse to the Government funds. He holds, also, that it would subject the Canadian Pacific to competition with the Government, and would place the Government in the embarrassing position of operating railroads in the United States.

He believes the Canadian Northern has been prudently handled, considering the means and equipment available, and sees no reason for a reorganization of it. He thinks the main difficulty with the Grand Trunk is the burden of the Grand Trunk Pacific, from which it should be relieved. He does not think, however, in view of the deferred maintenance of $21,000,000, the charges to capital of items that should have been charged to income, and the payment of dividends not earned, that the Government should guarantee the company an annuity. Rather, he would make the company work out its own salvation, but relieved of the unsupportable burden of the Grand Trunk Pacific.

Would Continue Private Operation

Mr. Smith summarizes his plan thus tersely:

"Let the Canadian Pacific alone; let the Grand Trunk operate the eastern lines now held by that company and the Canadian Northern; let the Canadian Northern operate the western lines now held by that company and the Grand Trunk Pacific system; let the Government operate the connections or procure their operation by private companies—all of which should be done under arrangements that are equitable and yet look to the not-distant day when the country will have survived the war and resumed its prosperous growth."

For bringing the foregoing about, he makes the following suggestions:

1. Amend the regulating policy so that the railway commission may have jurisdiction over all railroads in the matter of maximum and minimum rates, the issuance of securities, the building of new railways or the extension of lines and other matters properly within the scope of governmental supervision.

2. Create a board of trustees, consisting of two Government officials and three private citizens to act for the Government in the matters hereinafter proposed.

Redivision on Geographical Lines

3. Relieve the Grand Trunk of its obligation to lease the National Transcontinental, and require the company to relinquish all claims upon the National Transcontinental; require it to lease to the board of trustees the Grand Trunk Pacific properties at a rental amounting to the net annual fixed charges; require it also to take under lease the Canadian Northern properties east of North Bay and Parry Sound, and pay as a rental the net fixed charges on those properties. The time of the lease should be for 21 years.

4. Require the Canadian Northern to confine its operations to the field west of Winnipeg. Relieve it of the lines east of Winnipeg by leasing for 21 years to the governmental board of trustees, at a rental of the net annual fixed charges. Require it to take a lease of, and operate for the same period, the Grand Trunk Pacific and its branch lines, paying as rental the net annual fixed charges upon those properties—except that until 7 years after the end of the war they shall have the immunity that was promised the Grand Trunk Pacific for a period of 7 years after construction.

5. Lease the lines between North Bay and Winnipeg (except the Canadian Pacific) for a term of 21 years to either the Canadian Northern or the Grand Trunk (or, in event neither applies, to any other qualified company), requiring the lessee to furnish the necessary capital for new equipment and to maintain and operate the line on the best terms that can be made. Either the Government or the lessee should build a connecting line of about 30 miles near Long Lake, Ontario, to perfect the better working of the two lines.

6. Give Government and companies the option of terminating, after 10 years, any of the leases upon equitable terms.

Alternative Plan

If for any reason it should prove inexpedient to carry out the foregoing suggestions, and if the Government should find it wise or necessary to possess itself of any considerable part of the railway properties, Mr. Smith would recommend as an alternative plan the formation of a private company to take over other operations of those properties, either as a whole or in groups. Even where a road does not earn its fixed charges, he thinks the Government could profit in the long run by making the terms of an operating lease sufficiently attractive to induce private enterprise to undertake its management. Contracts might be based upon a profit-sharing plan on a fair basis, which would leave the company a hope of reward commensurate with its efforts and give the public also a share in the prosperity which they must help to create.

Mr. Tye's Consolidation Plan

From the engineering point of view, W. F. Tye's plan, as presented before the Canadian Society of Civil Engineers, seems to deserve a place with those of the Royal Commission. His paper presents much in the way of figures, and also diagrams, maps and profiles, from one of which Fig. 2, showing his general scheme, was prepared.

Mr. Tye's scheme, embodying the consolidation feature of the majority report and the private-ownership feature of the minority report, is in a way more drastic than either. He would ruthlessly dismember four trunk lines—the Grand Trunk, Grand Trunk Pacific, Canadian Northern and National Transcontinental—to develop one worthy competitor of the Canadian Pacific, and would abandon such lines as he found not useful.

East of Winnipeg the air-line National Transcontinental would be utilized as the main line. The National Transcontinental branch to Port Arthur would also be used, and a small amount of construction would bring the system to St. John, N. B. Connections with Montreal and Toronto would be effected by the use of the Canadian Northern to Long Lake, where the construction of a 30-mile connection with the National Transcontinental would eliminate the Canadian Northern as a main line

from Long Lake west. The Grand Trunk would provide the connection between Montreal and Toronto, and most of the system of feeders in the eastern section.

West of Winnipeg the Grand Trunk Pacific would provide the main line to Prince Rupert, the Canadian Northern supplying the feeders. The Canadian Northern would also supply a main line connection to Vancouver.

Better Lines and Grades than Now Exist

Comparing this new railroad with the existing lines, the length from Quebec to Vancouver would be 2906 miles, as compared with 3047 for the Canadian Pacific, 3111 for the National Transcontinental and Grand Trunk, and 3207 for the Canadian Northern. The distance from Montreal to Winnipeg would be 64 miles shorter than by the Canadian Pacific; that from Toronto to Winnipeg, 28 miles shorter. The distance from Winnipeg to Vancouver would be 72 miles longer than the Canadian Pacific, but 44 miles shorter than the Canadian Northern, and 205 miles shorter than the proposed Grand Trunk connection.

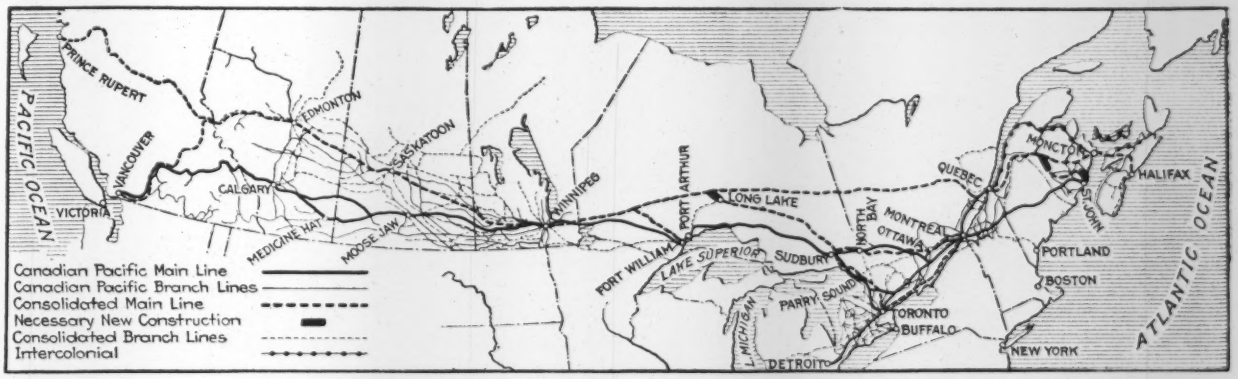


FIG. 2. MAIN LINES FOR TYE PLAN WOULD BE PARTS OF THE GRAND TRUNK, GRAND TRUNK PACIFIC, CANADIAN NORTHERN AND NATIONAL TRANSCONTINENTAL

As to grades, from Edmonton to Montreal, Toronto and Quebec there would be no grade steeper than 0.4% against eastbound and 0.6% against westbound traffic. From Edmonton to Vancouver the maximum grade would be 0.7% eastbound and 0.4% westbound. The main lines as now constructed have many miles of 1% grades, while the Canadian Pacific in the Rocky and Selkirk Mountains has many miles of 2.2% grades against both eastbound and westbound traffic. Thus the new consolidated line would have the best grades as well as the shortest line.

Mr. Tye estimates that in order to develop the Grand Trunk and the Canadian Northern separately to compete with the Canadian Pacific, many thousands of miles of branch lines as feeders would have to be built, at a cost of not less than $300,000,000. On the other hand, he figures that $185,000,000 would finance the consolidation and provide it with sufficient funds for improvements and betterments for five years.

Settlement with Present Owners

His idea of an equitable settlement with the present security holders is rather different from that of Sir Henry Drayton and Mr. Acworth. He holds that the common stock of the Canadian Northern and the Grand Trunk Pacific is at present valueless, and he lays no stress on the desirability of special consideration for the Canadian Northern shareholders on the ground that their optimism was justifiable, or because of their part in developing the prairie provinces. He would have the stock of both taken over and given to the new company, a small amount of stock in the new consolidation to be given to the shareholders of the old companies.

In the case of the Grand Trunk, however, he notes that it is earning a great deal more than its fixed charges, and that its capital would have to be acquired. The present market value of this stock is given by him as $71,000,000. He thinks that the shareholders might be satisfied to take preferred stock, or some other form of securities, in the new consolidation, in exchange for their present securities, but that in any event $85,000,000 would be an amply large valuation.

Thus this $85,000,000 would represent the entire cash outlay for the existing properties, but he thinks an additional $100,000,000 should be raised to provide for improvement and betterment until such time as the new company would be financially on its feet.

Prospects of New Company

He would not hope to have the company make expenses from the start. He holds, however, that there is no way to make these roads self-supporting immediately. He estimates fixed charges of $34,603,017, to which he would add, after seven years, $5,400,000 for the rental of the National Transcontinental Ry., the ownership of which would remain with the government. For this first year he thinks there would be a deficit of nearly $6,000,000, but in five or ten years he thinks this would be turned into a surplus.

In order to control its policy and to share in the prosperity that he thinks would be certain, he holds that the government should have a 40% ownership in the stock, putting up 40% of the money and appointing 40% of the directorate, but taking no part in the actual management. He believes Canadians would subscribe for 11 or 12% more of the stock, so that even though the rest of the money had to be raised in New York, control of the property would rest in Canada.

His final conclusion is that once the combination is successful, "Canada should once and for all abandon the vicious policy of bonusing railway construction, either by gifts of money or land, or by the still more vicious policy of guaranteeing the bonds of railway companies of which it has no direct control."

ENGINEERING LITERATURE

A Review of Books and a Listing of New Publications

Great Stone and Concrete Arch Bridges of the World

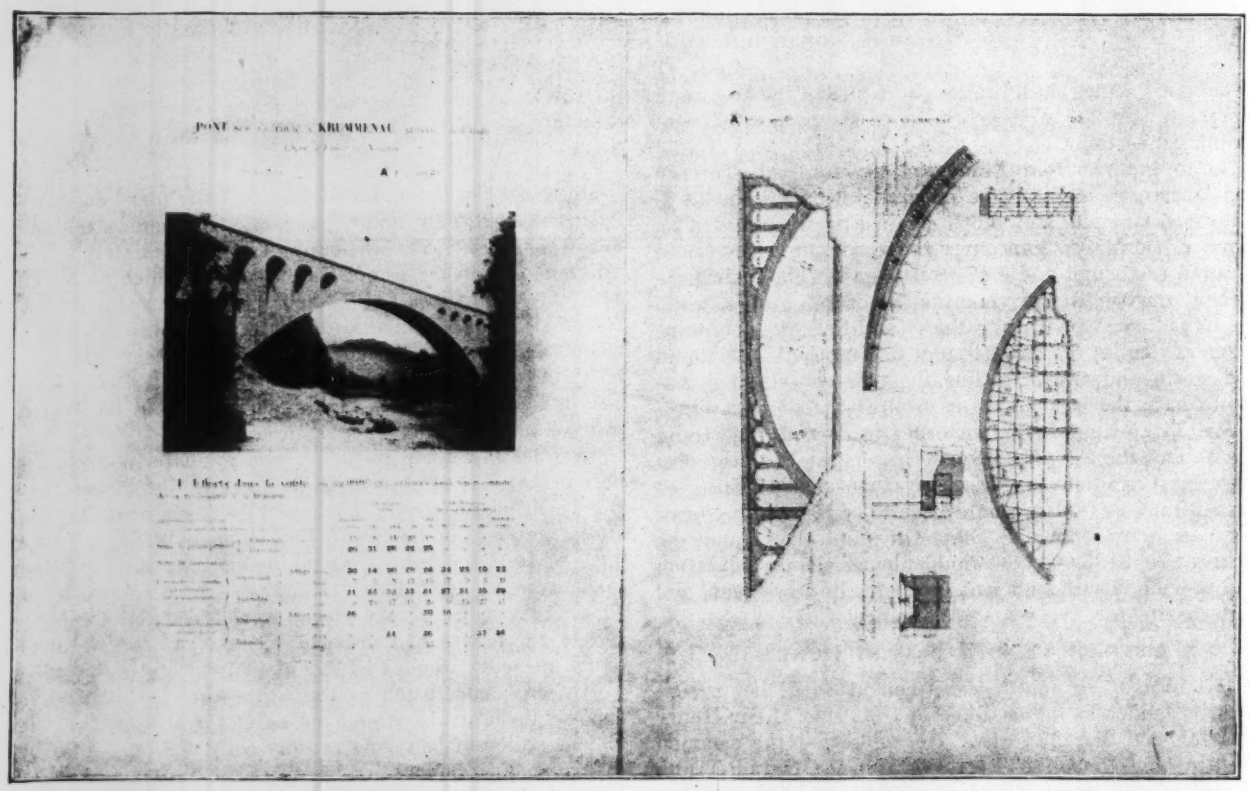
An Appreciation by Dr. J. A. L. WADDELL
Consulting Engineer, New York City

GRANDES VOUTES—Par Paul Séjourné, Ingénieur en Chef des Ponts et Chaussées. Paris, France: Tardy-Pigelet et Fils. In six volumes. Paper: 10 x 13 in.; pp. 1732; 334 half-tones and 896 other illustrations; numerous tables. 250 francs.

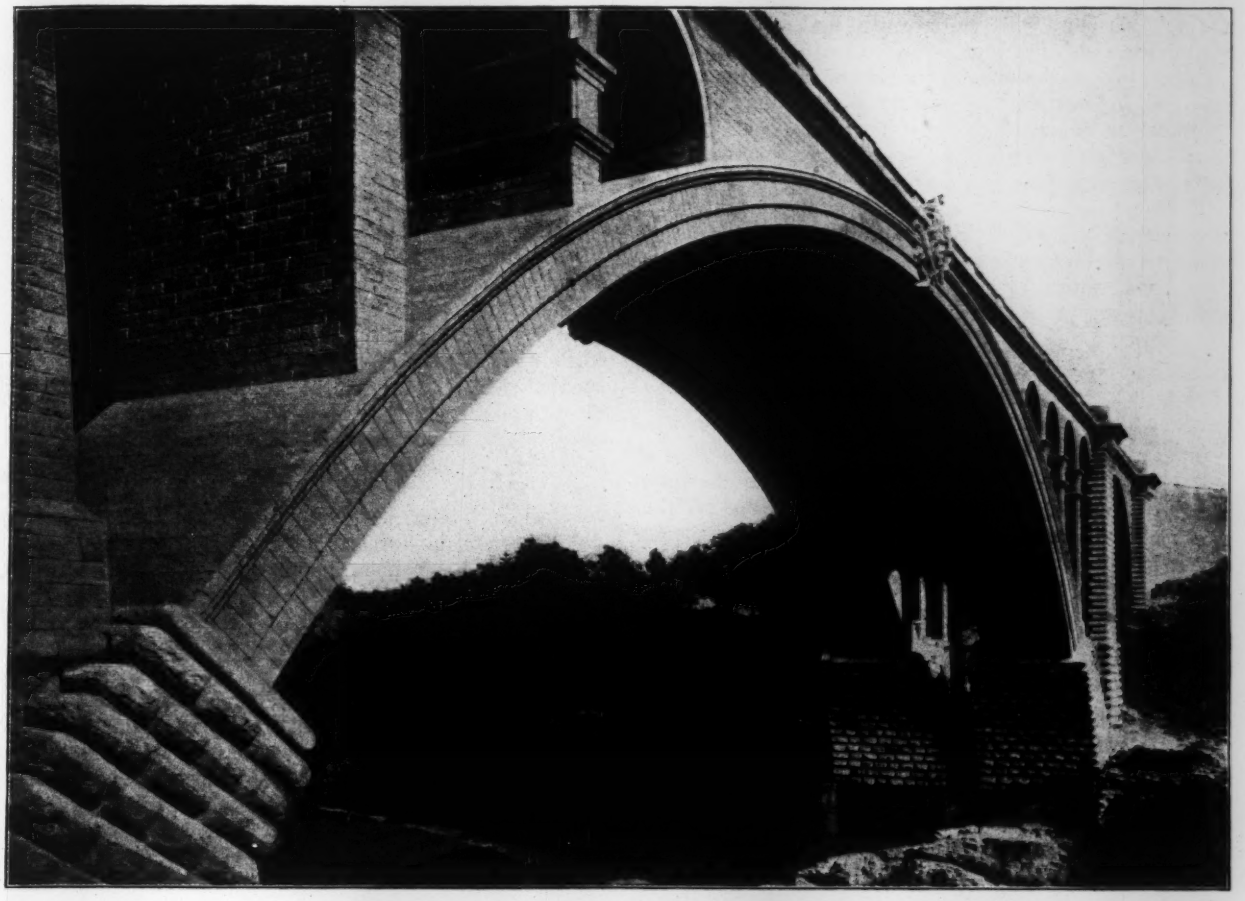
MY GOOD friend, Monsieur Paul Séjourné, the eminent French engineer, has produced the most monumental engineering treatise I have ever seen. There is no telling what portion of the 40-odd years of his professional career he devoted to the collection and preparation of the material contained in these six handsome volumes. Doubtless it was considerably over a decade, for he was hard at work on it when I first met him in Paris in 1909. The first volume appeared in 1913, and the last came out late in 1916.

Adopting 40 m. (131¼ ft.) as the minimum span-length for illustration and discussion, the author aimed to include the principal masonry and reinforced-concrete bridges of the world. Austria, England, France, Germany, Luxembourg, Italy, Norway, Switzerland and the United States are represented, but of his more than two hundred examples it is natural that most were chosen from France.

As there is no other such treatise as this in existence, and since, as a book of reference, it must certainly be invaluable to any engineer who practices at all in the line of reinforced-concrete bridge designing, there ought to be quite a demand for the work in this country. Even if one does not understand a single word of French, the book will prove to be an inspiration—not only in æsthetics, but also in regard to numerous important points of construction. While the cost (250 francs, or about $50) is prohibitory for many American engineers, anyone doing reinforced-concrete bridgework, no matter in how small a way, should either own or have at his command a copy of the book. The public libraries of the great centers of population where engineers congregate, and those of the universities, colleges, and technical schools where engineering is taught, should carry the work on their shelves, because its regular use as a book of reference by American bridge specialists and students in structural engineering would soon improve materially the status of the designing of reinforced-concrete structures—as far, at least, as the feature of æsthetics is concerned. Anyone who neglects



FACING PAGES FROM "GRANDES VOUTES" SHOW ITS UNIQUE PLAN OF DESCRIBING GREAT ARCH BRIDGES
The printed portion of the original pages is 5⅛ x 8⅝ in.



AN ILLUSTRATION THAT ILLUSTRATES: PONTE ADOLPHE A. LUXEMBOURG

Not only the general effect of the whole bridge, but the rusticated branches and other details are shown in a useful and inspiring way. This is a characteristic of the hundreds of halftones in Séjourné's "Grandes Voutes"

to study the illustrations, collected by Monsieur Séjourné through the expenditure of so much time, effort, and money, will assuredly fall behind in competition with those who do study them thoroughly and systematically.

The paper on which the book is printed is unusually heavy (the six volumes weigh 25 lb.) and somewhat brittle, necessitating a certain amount of care in handling, in order to avoid creasing and cracking. The typography is fine, and the finish of the illustrations is excellent.

Besides the 1230 illustrations there are tables too numerous to count; in fact, most of the information given in the treatise is in tabular form—a method of recording that is eminently effective, especially when so ably handled as it has been by Monsieur Séjourné. The fullness of the statistics furnished is remarkable, covering as they do practically every item of information concerning the various structures that one could desire. At the end of the sixth volume are given tables that serve as a compendium of the information furnished, but unfortunately there is no topical index such as American technical writers prepare for their treatises. This defect is not as serious as it would be in an ordinary engineering book, because the first four volumes are devoted almost entirely to the records of existing arch bridges, and these tabulations, in a way, index themselves; but Volumes V and VI, which deal with the theory of arch design and with detailing, would be more useful if thoroughly indexed.

An interesting feature of Volume V is a table (page 206) giving the principal dimensions and other information concerning the arches of greatest span belonging to various periods, commencing with A.D. 1339.

Monsieur Séjourné begins his preface with these words: *On fait une voûte d'après les voûtes faites: c' est affaire d'expérience.* [Literally: "One makes an arch after arches already made; it is a matter of experience.] In general, this statement may be taken as correct, especially in Europe, where the worship of precedent prevails in engineering practice; but it is not quite true in this country, because American bridge designers are continually trying to evolve new types and to effect improvements in old ones. Sometimes the result of the innovation is happy; but quite often it is the contrary, as certain failures of reinforced-concrete structures have proved. The bridge designer who has the ambition to produce something novel in reinforced-concrete arch construction would do well to peruse carefully the contents of "Grandes Voûtes" and see whether he can find any precedent that would warrant him in making the attempt or any indication that his proposed innovation would be likely to prove unsuccessful.

The limited space available to the reviewer prevents even the shortest discussion of Monsieur Séjourné text. Suffice it to say that his treatment is both elegant and thorough as well as classic and polished—in short, it is in

complete harmony with the beautiful and attractive style in which the book has been prepared by the publishers.

In conclusion, the reviewer can do no better than to repeat and indorse without reservation the remark made by Monsieur Séjourné in the last paragraph of the preface: *L'ingenieur chargé de projetor, de construire une voûte, trouvera dans cet ouvrage ce qui a été fait, ce qu'il faut faire, ce qu'il ne faut pas faire.* [Literally: "The engineer charged with planning and building an arch will find in this work that which has been done, that which must be done, that which must not be done."]

The Revised Edition

By R. FLEMING

American Bridge Co., 30 Church St., New York City

What is a revised edition? Revisions vary in kind as well as in degree, and no standard nomenclature has been adopted by publishers to describe the varieties of revision of a book. The practical question that confronts the engineer is, Are the revisions sufficient to warrant his discarding the book he already possesses and purchasing the new one? In many cases he makes his decision from the title page as it appears in the book itself or as given in the publisher's catalog.

The many ways in which revisions are announced may be seen from the following examples, copied from title pages of a wide range of technical books: "Revised Edition"; "Second Edition, Revised"; "First Edition, Second Impression, Corrected"; "Revised and Enlarged by an Appendix"; "Fifth Edition, Thoroughly Revised"; "Fourth Edition, Corrected"; Sixth Edition, Completely Revised and Enlarged"; "Seventh Edition with Important Supplement"; "Tenth Edition, Rewritten and Enlarged"; "New Edition, Entirely Rewritten"; "Fifth Edition, Entirely Rewritten"; "Sixth Edition, Completely Revised and Enlarged"; "Third Impression—Eighth Thousand Corrected"; "Seventh Edition, Revised and Enlarged, New Impression"; "120th Thousand, 19th Edition, Third Issue"; "Ninth Edition, Revised and Reset"; "Sixteenth Edition, Rewritten"; "Fourth Edition, Reprinted"; "Fifteenth Edition, New Impression."

The words "Revised Edition" or "Second Edition, Revised" mean little. The "revision" may be simply a correction of errors. In such cases the title page is misleading, and disgust on the part of the purchaser will follow. The word "corrected" instead of "revised" should be used. "First Edition, Second Impression, Corrected" or "Tenth Edition, Rewritten and Enlarged" states exactly the scope of the new printing. It is true that a preface or an introductory note can give in detail the nature of the changes made, but the title page is read first. Therefore, it should convey no wrong impression.

A common cause of annoyance is to find a book dated the current year, but printed from plates of several years previous. An extreme case is that of a treatise on bridge building, the title page of which bears the date 1899, and the following page, "Entered according to Act of Congress in the year 1873." In contrast to this is an engineers' handbook with the imprint 1914 (the date of the first printing) and also, "First Edition, Eighth Thousand (Printed in 1916)." This is ideal for the purchaser, but inconvenient to cite for reference, especially if errors are corrected in the different reprintings. Another handbook that has reached a circulation of over 100,000 copies does not bear the number of the edition or the date of issue on the title page or in the introduction. The five copyright dates are given in rather fine print on the page following the title. The subject of title-page dates was discussed in *Engineering News* of Dec. 18, 1913, pp. 1263; Jan. 15, Feb. 12 and Mar. 19, 1914, pp. 155, 370 and 645; July 16 and Aug. 20, 1914, pp. 161 and 379 and need not be further mentioned here.

It is important that the engineer should know whether or not he is using the latest issue of a book. The reader of a certain book on structural design will be led far astray if he follows the formula and table in the first edition giving the safe loads that can be carried by corrugated-steel roofing. In the second issue of the book the errors are corrected. Again, an engineer may be called upon to make a research and report. He goes to the best collection of technical books available and finds from five to fifty books bearing on the subject. He states his conclusions, giving his authorities, often to find that he did not quote the author's latest thought or that his conclusions are based upon erroneous figures that had been corrected in later editions than the ones he used. How can this difficulty be avoided? The writer has talked with several librarians, but none of them have any remedy to offer. It is impracticable for a library to keep all the revised and corrected editions of technical books. It is suggested that, as soon as a new edition is announced, the librarian paste a slip in the book on hand, reading, "A revised (or corrected) edition of this book has been issued bearing the date ———." The reader then knows that a later edition has been printed. He must decide if it is advisable for him to consult it or if the present book is sufficient for his needs.

REVIEWS AND NOTES

Military Explosives and Ammunition

NOTES ON MILITARY EXPLOSIVES—By Erasmus M. Weaver, Major General, U. S. A.; Chief of Coast Artillery. Fourth edition, revised and enlarged. New York: John Wiley & Sons. London: Chapman & Hall. Cloth; 6 x 9 in.; pp. 390; illustrated. $3.25 net.

MANUFACTURE OF ARTILLERY AMMUNITION—By Members of the Editorial Staff of the "American Machinist": L. P. Alford, Editor in Chief; F. H. Colvin, E. A. Suverkrop, Robert Mawson, John H. Van Deventer, New York: McGraw-Hill Book Co., Inc. Cloth; 6 x 9 in.; pp. xii + 765; 669 illustrations. $6 net.

General Weaver's treatise on military explosives has long been one of the most important books in the engineer's military library, but the past four years have made the previous edition inadequate in regard to use, so that the present edition is welcome.

The book shows the leading developments wrought by the present war—particularly the employment of atmospheric nitrogen and the substitution of wood pulp for cotton. The text opens with some elementary notes on chemistry and descriptions of substances entering explosives. Then the characteristics and requirements of propelling, disrupting and detonating compounds are presented. There are chapters on tests, storage, handling and use for special demolitions.

An appendix contains (1) laboratory experiments to illustrate the section on chemistry, (2) an excellent paper by A. S. Cushman on "The Role of Chemistry in

War," and (3) the Interstate Commerce Commission regulations governing the transportation of explosives as freight.

An up-to-date text on munitions manufacture has been earnestly desired by the Council of National Defense and by every manufacturer who may have to turn his plant into an arsenal. The most obvious way to secure such a book was to reprint the papers that have appeared in the *American Machinist* since the onset of the European War. The contact with munitions manufacture is coming at so many points that this work will be needed by great numbers of industrial engineers who will not themselves bear the direct responsibility of manufacture.

The material splits up into sections on shrapnel, high-explosive shells, cartridge cases and fuses. In each field the manufacturing methods are disclosed for a variety of sizes; production data are given for each kind and size of ammunition shown.

New Book on Riveted Joints

Reviewed by DEXTER S. KIMBALL

Professor of Machine Design and Industrial Engineering, Sibley College, Cornell University, Ithaca, N. Y.

RIVETED BOILER JOINTS: A Treatise on the Design and Failures of Riveted Boiler Joints, with Numerous Original Diagrams Enabling the Designer To Design Any Desired Joint Without Calculations—By S. F. Jeter, Member of Boiler Code Committee, Am. Soc. M. E. New York: McGraw-Hill Book Co., Inc. Cloth; 11 x 8 in.; pp. ix + 155; 52 illustrations. $3 net.

The purpose of this book is to assist designers of boilers and those who have to do with inspecting such construction. It consists of 12 chapters, as follows: (1) "Methods of Joint Failure"; (2) "Types of Boiler Joints"; (3 and 4) "Efficiencies of Boiler Joints"; (5) "Boiler Plate Material"; (6) "Strap Thicknesses and Rivet Diameters"; (7) "Limiting Pitches"; (8) "Boiler Joint Diagrams"; (9, 10 and 11) "Making Joint Diagrams"; (12) "Riveted Joints of Maximum Efficiency."

The first seven chapters contain a general discussion of the mathematics of the strength of riveted joints, which follows the usual method of making the strength of such joints depend on the tensile strength of the plate, the shearing strength of the rivets and the crushing strength of the material. In Chapters 3 and 4 the author illustrates the calculation of the efficiency of joints by assigning actual dimensions and allowable stresses to typical joints and comparing the relative resistances to rupture. The equations for the efficiency of typical joints are also given in tabulated form. The usual equations for uniform strength of riveted joints are not developed here.

Chapter 5, devoted to the materials for boilers, is hardly worthy of the name. It consists of one page only and is utterly inadequate for its purpose. Logically, also, it should appear earlier in the volume. This last is true also of Chapters 3 and 4; for while a great deal is said in Chapter 2 regarding efficiencies of joints, this term is not defined or its calculation explained until Chapter 3 is reached.

The most important features of the book and also the most original are the boiler-joint diagrams and the discussion concerning them in Chapters 8, 9, 10 and 11. Each diagram gives the efficiency of the particular joint represented, for varying spacing of rivets and varying thickness of plate with a given size of rivet. The diagrams are simple in construction and are easily read; they should be very helpful to designers and inspectors who are constantly either designing or inspecting. Like all similar diagrams, they are of doubtful value to the engineer who has to make an occasional calculation of this kind and to whom an equation is easier to become re-acquainted with than is a diagram. These diagrams, however, should be of particular value to those constantly employed in calculations affecting riveted joints.

The diagrams illustrated are based on fixed values for the strength of the materials used. It is assumed also that the crushing strength of rivets in single shear may be taken at 44,000 lb. per sq.in., and at 88,000 lb. per sq.in. in double shear, though it is generally accepted that rivets in double shear are stronger in proportion than those in single shear. However, in Chapters 10 and 11 the author explains the method of making these diagrams and the reasons why they are correct. This discussion requires a knowledge of the elements of analytical geometry and may be beyond many draftsmen, who must therefore accept the diagrams given as correct and base their designs on the physical values assumed, all of which may limit the usefulness of the book in some respects.

The last chapter is a mathematical discussion of the methods of designing joints of maximum efficiency. In this chapter the author returns to the discussion of the basic principles of the design of riveted joints and develops the mathematical limitations of uniform strength and maximum efficiency. He then applies the general criteria so developed to joints of various kinds. This discussion is of a more advanced character than that contained in the first chapters.

On the whole, the book is a real addition to the literature of the subject. As has been noted, it should be useful to designers and inspectors of the structures discussed, but it may prove somewhat difficult for beginners. The usefulness of the book could also be much enlarged by the addition of practical data and a discussion of the limitations that often prevent the practical realization of theoretical results.

Government Ownership Condemned

GOVERNMENT TELEPHONES: The Experience of Manitoba, Canada—By James Mavor, Ph. D., Professor of Political Economy in the University of Toronto. New York: Moffat, Yard & Co. Cloth; 5x8 in.; pp. viii + 175. $1 net.

A bad case for government ownership of telephones in the Province of Manitoba is made out by Professor Mavor. It should be noted, however, that he is a strong disbeliever in public ownership of utilities of any sort, holding "that the proper function of government is not the conduct of industries, but the impartial inspection of them under intelligent laws adapted to the character and conditions of the community and the country."

The book starts with the purchase of the Bell system by the province in 1907 and comes down to 1914, when the author visited Manitoba for the purpose of his study. An analysis of the telephone accounts shows considerable loss under government ownership, on adding what the author believes to be proper allowances for depreciation—no depreciation at all being charged up at the start. Promised heavy reduction in tolls did not materialize, but what the author believes to have been unwarranted rural extensions were made. General mismanagement, political favoritism and the like are claimed by the author, with

documentary evidence and opposition newspaper assertions for proof.

Although notably one-sided, the general impression created by the book is that, measured by business standards, government telephones in Manitoba were a failure. Whether there were any compensating advantages, such as are alleged by many to result from operating a postal service at a loss, the method of the author is not of the sort to show. Even if there were such, the record shows inexcusable mismanagement, political juggling and that disregard of sound accounting which is so common in municipal, state and national government.

Two Books on Railway Location

Reviewed by M. P. PARET

Division of Valuation, Interstate Commerce Commission, Wells Fargo Building, San Francisco, Calif.

THE DESIGN OF RAILWAY LOCATION: A Study of the Physical and Economic Conditions That Control the Location of Railways in Order That Their Operation May Be at Maximum Safety and Efficiency—By Clement C. Williams, Assoc. M. Am. Soc. C. E. New York: John Wiley & Sons, Inc. Cloth: 6 x 9 in.; pp. vii + 517; 106 illustrations. $3.50 net.

INSTRUCTIONS TO LOCATING ENGINEERS AND FIELD PARTIES—By F. Lavis, M. Am. Soc. C. E. Reproduced in abridged form from "Railroad Location Surveys and Estimates." New York: McGraw-Hill Book Co., Inc. Cloth; 6 x 9 in.; pp. 44; illustrated. $1 net.

In his introduction Mr. Williams seems to make the duties of the locating engineer too great and the scope of his ability and judgment too broad when he states that the intricacies of railway financing, organization, legislation, the legal status of carriers, rate making and valuation should be understood by him. One may be a very capable locating engineer, indeed, without an understanding of all these elements of railroad building. There seems to be a confusion of the duties of the locating engineer with those of the chief engineer.

In Chapter IV, "Valuation of Railways," there is set forth a comprehensive condensation of the much that has been written on the subject. In the paragraph on "Meaning of Valuation" the author gives a definition of valuation as one most nearly meeting the requirements. This definition seems abstruse. Should not valuation be the determination of the worth of something, giving worth a definition covering the purpose of the determination if there be one? Valuation has been called "a state of mind," and it is true that the point of view governs. The reviewer once gave to valuation the same definition that St. Paul gave to faith—namely, "The substance of things hoped for, the evidence of things not seen"—as setting forth the point of view of the carriers in the first part of the quotation and of the Government in the last part.

If such elements as contingencies, working capital and abandoned property are to be included in cost of reproduction new as properly features of such cost, they will be hard to define and harder to determine. An allowance for something unforeseen and liable to occur, the extent of which is pure guesswork, does not enhance the defensibility of valuation work. The possibility of work being more or less costly should be reflected in the unit prices. An allowance for contingencies, in connection with railway-construction work which has been planned and surveyed and for which estimates have been made, is quite another matter from an allowance for contingencies in connection with an estimate for cost of reproduction new of a property already built and in existence. In the latter case there are but few elements of cost unlooked for or not estimated for, of which there is not evidence on the ground or in the carriers' records and which cannot and should not be included in the quantities or unit costs of such estimates. Why, in making an estimate of what is, should an allowance be made for what is not, was not and might never be? Abandoned property seems, possibly, a proper charge against original cost to date. Is it an asset of value to be covered by a mortgage?

In describing the method of procedure of the Division of Valuation of the Interstate Commerce Commission in its fieldwork of valuation, the author makes no reference to the fact that the work done is joint or coöperative as between the commission's engineers and those of the carrier.

The definition of "railway location" in Chapter V, "Volume of Traffic," includes "transportation plant." The economic location of a route for transportation purposes is not dependent upon an economic plant for operation or upon an economic management of the same, but economic operation is dependent upon economic location. Why not define railroad location as "the science of establishing a route for transportation purposes based on economic construction, operation and maintenance"?

Under "Operating Conditions Affecting Location," Chapters VIII to XVII, the author sets forth the latest, most pertinent and best of the literature and information on the subjects touched upon. The general arrangement, the sequence and the author's editing and opinions show a careful consideration for the purpose of the publication.

Chapters XVIII to XXI, "Special Problems in Railway Location," might well have included a chapter on branch lines considered as feeders for the trunk line, in connection with the development of country and revenue.

There is in the text a praiseworthy lack of inconsequential and irrelevant detail, an efficient segregation and sequence of the subject matter and a careful consideration of its expressed purpose. The book as a whole is an excellent compilation of the essentials governing most modern theories and practices on the subject, as generally adopted by the profession. The personality of the author appears strongly and in a practical manner. The book should serve more than its immediate purpose and may well be in the library of every student of the subject, whether in or out of college.

Mr. Lavis states in his preface that his "Instructions" were finally prepared in their present form for use in China. The instructions are largely a modified, brief condensation of pertinent matter from the author's excellent treatise on "Railroad Location Surveys and Estimates," but there seems to be nothing in the instruction which would be pertinent, applicable or useful for work to be done specifically in either China or South America. The author's experience in foreign countries would warrant his setting forth some information relative to labor conditions, transportation facilities, governmental requirements, climatic and health conditions abroad.

The text on the subject of the keeping and distribution of accounts is timely and desirable. The reviewer is most heartily in accord with what the author has to say about the desirability of teamwork. This, undoubtedly, leads to practical efficiency and to the best results.

It seems as if the printer might have slipped a cog and placed the text following "economic values," "curvature," "distance," "rise and fall" and "pusher engines," near the text on the subject of "curves." Seemingly, the more appropriate place for the subject matter referred to would have been in the rear of the book before "train resistance."

It was the reviewer's privilege (*Engineering News*, Jan. 17, 1907) to review the author's treatise on "Railroad Location Surveys and Estimates." He will say of the "Instructions," as he did of the earlier treatise, that it is comprehensive, is an excellent epitome of good modern practice and is well adapted to the purpose for which it was designed. In fact, it is the best and the most practical exposition of the subject matter under consideration that has met the eye of the reviewer. For the actual practical handling of the class of railroad work referred to, no better method could be adopted and used.

Practical Notes on Use of Electrical Equipment

ELECTRICAL EQUIPMENT, ITS SELECTION AND ARRANGEMENT, with Reference to Factories, Shops and Industrial Plants—By Harold W. Brown, B. S., M. M. E., Department of Electrical Engineering, Cornell University. New York: McGraw-Hill Book Co., Inc. Cloth; 6 x 9 in.; p. xiii + 229; 109 illustrations. $2 net.

Non-electrical men who have problems in the selection and use of electrical equipment put up to them, will welcome Mr. Brown's lectures. The book supplements, and does not duplicate, existing recognized texts which describe electrical apparatus or present the principles of design and application or give various performance data. Its aim, in contrast, is to show how to apply principles and data elsewhere accessible.

The first chapter is on depicting circuits: the second is on the requisites of power plants and distribution systems. The next chapter is on how to choose between alternating or direct current. Then the text takes up motors, transformers, converters and storage batteries. One chapter gives some essentials of illumination.

All these are rather general matters; the following chapters go more into the details of transmission and distribution system, power apparatus, control equipment, lightning protection, switchboard instruments, etc. One chapter summarizes possible costs for all sorts of installations, and the final section gathers up illustrative examples.

Petroleum Production and Refining

THE AMERICAN PETROLEUM INDUSTRY—By Raymond Foss Bacon, Director, and Allen Hamor, Assistant Director of the Mellon Institute of Industrial Research of the University of Pittsburgh. New York: McGraw-Hill Book Co., Inc. Cloth; 6 x 9 in., Vol. I; pp. x + 446; 155 illustrations. Special chapters by F. G. Clapp, Roswell H. Johnson, J. P. Cappeau and L. G. Huntley. Vol. II; pp. vi + 447-963; 173 illustrations. $10 a set.

The inquiries received by the editors of this journal and its two predecessors showed that there was a demand for a book giving a comprehensive view of the American petroleum industry and technology. These volumes appear to meet the demand.

Volume I deals with the natural product and Volume II with refining. The first few chapters of the first volume are devoted to geochemistry, geology and physical and chemical properties; a second group presents the distribution of oil and the history of the industry. The third group takes up well drilling and oil handling, valuation of oil property, causes of decline in yield, more efficient production, condensation of gasoline gas, etc.

The first part of Volume II treats of refining processes and products, and a second part shows refinery apparatus and engineering. In the third part is a chapter on petroleum poisoning and hygienic measures around works, a chapter describing the shale-distillation industry, and a glossary of terms and definitions.

The names of the various authors carry sufficient guarantee of the accurate presentation of data on most of the branches of the industry, and they have strengthened their position in the other special fields by the aid of many collaborators.

Industrial Accounting

Reviewed by ELIHU CUNYINGHAM CHURCH
Consulting Engineer, New York City

UNIFIED ACCOUNTING METHODS FOR INDUSTRIALS—By Clinton E. Woods. New York: The Ronald Press Co. Half leather; 6 x 9 in.; pp. 550; illustrated. $5 postpaid.

Manufacturing never before played as important a part in the scheme of things as now, nor have we ever faced a time when industrial efficiency, bred of necessity, has operated more ruthlessly to crowd out the unfit. The day has come when the control of enterprises must be based on scientific methods and exact facts, not on guesswork, and the author of this book, as a man of much training and experience, states the case clearly.

He has prepared for the benefit of "the executive, the engineer and the accountant" who are connected with manufacturing and industrial activities a book designed to indicate the basic principles on which they must work, to enable them to measure accurately their results and to show so clearly what they are doing that they may effect the necessary improvements for obtaining the greatest possible success.

The book has mainly to do with accounting. However, it opens with an admirable chapter on industrial or efficiency engineering, which points out many interesting fundamentals of manufacturing and selling for profit. The second chapter analyzes a manager's monthly balance sheet and shows the main items of information that such an executive should have to guide him in his work. Then come chapters on purchasing, storekeeping, production and schedules. The employment and handling of labor are considered, as are distribution, commercial or office accounting, controlling accounts and so forth. The last hundred pages are devoted to forms that illustrate the points made in the text.

The book shows care and thoroughness in preparation. It is a book to be studied and worked with, not to be skimmed through. The fact that one does not always agree with the author does not impair the usefulness of the volume. It merely means that the reader must justify to himself that certain of his own methods, differing from those set down, are better for him than those given by the author.

Industrial Power Engineering

ENGINEERING OF POWER PLANTS—By Robert H. Fernald, M. E., A. M., Ph. D., Whitney Professor of Dynamical Engineering, University of Pennsylvania, and George A. Orrok, M. E., Consulting Engineer, New York. New York: McGraw-Hill Book Co., Inc. Cloth; 6 x 9 in.; pp. ix + 586; 309 illustrations. $4 net.

To the worthy treatises on power-plant engineering of Gebhardt, Hutton, Hubbard and others, these eminent

authors have added an equally worthy volume. The new book is of great interest to industrial-plant owners and engineers, as the treatment is both by description and discussion and introduces specific data at every turn. All kinds of power are touched on, though steam and internal-combustion plants are naturally given the most space.

Handbook of Engineering Conduct

CONTRACTS, SPECIFICATIONS AND ENGINEERING RELATIONS—By Daniel W. Mead, Consulting Engineer, Professor of Hydraulic and Sanitary Engineering, University of Wisconsin. New York: McGraw-Hill Book Co., Inc. Cloth; 6 x 9 in.; pp. 535; illustrated. $3 net.

A complete outline of professional conduct in engineering relations from hunting a "job" to drawing a contract is set forth in this work for the benefit of the college student. The book, however, has a much wider application than educating the engineering student, since it would seem that others besides undergraduates could pursue further the study of engineering contract preparation with benefit to themselves and their clients.

So far as the subject of contract writing is concerned, the book is to be preferred to any work published in recent years. Its chief claim to this distinction is the clearness and persistence with which the point is driven in that the one object of contracts and specifications is to secure the results desired by the owner of the structure at the lowest reasonable cost for which they can be provided. This means, as is clearly stated all through the sections of the book dealing with this subject, that the mistake of putting insufficient work into the preliminary investigations and design, as well as ambiguous specifications, uncertain general clauses, and clauses conferring discretionary powers on the engineer which might be exercised, for all the bidders know, to cause a wide variation in the cost of the work, must all be carefully avoided. The work is a good summary of technical literature on this subject to-date, and contains an extensive bibliography, including many references to articles in current engineering journals which the reader would otherwise have difficulty in locating. This bibliography shows that the author's conclusions have been reached after a study of most of the information available on this subject.

As for the form of the treatise, a consistent attempt is apparent throughout to train the student to analyze logically each piece of work for which a contract and specifications are to be written. The value of definite and clear expression is well emphasized. The book deserves a place in every engineer's library.

American Gas Manufacture

OPERATION OF GAS WORKS—By Walter M. Russell, Jun., American Institute of Chemical Engineers. New York: McGraw-Hill Book Co., Inc. Cloth; 6 x 9 in.; pp. x + 209; 76 illustrations. $2 net.

The growing use of manufactured-gas fuel in industrial plants and the increase in number of gas-works owned by manufacturing concerns have brought home to a wide circle of engineers outside the gas industry the lack of concise, easily read treatises on gas-works construction and operation. There has been of course the "catechism" of the Gas Institute, but this has not apparently been much utilized outside the industry.

Mr. Russell's book fills at least half the void, although not written with the industrial-plant engineers particularly in view. It deals with management and operation primarily and with apparatus and construction secondarily; therefore, what equipment is described is only representative.

First are presented organization and general management, both of plant and men. Then comes chemical control of product. One chapter is devoted to problems peculiar to coal-gas plants, another to water-gas production. Chapter V groups the general plant problems—handling materials, keeping cleaned up, fire protection, proper steam and water lines, keeping a good boiler house, etc. The final chapter discusses calorimetry and photometry, and an appendix gives miscellaneous useful tables.

Hoisting and Conveying Apparatus

THE MECHANICAL HANDLING AND STORING OF MATERIAL: Being a Treatise on the Handling and Storing of Material Such as Grain, Coal, Ore, Timber, Etc., by Automatic or Semi-Automatic Machinery, Together with the Various Accessories Used in the Manipulation of Such Plant—By George Frederick Zimmer, Assoc. M. Inst. C. E. New York: D. Van Nostrand Co. Cloth; 7 x 10 in.; pp. xiv + 752; 1044 illustrations. $12.50 net.

The facts that the field of engineering which this bulky treatise covers has had an enormous development in the past quarter century, and that comparatively little on the subject has been published, are the principal justifications for the purchase of the book by American engineers. The book is written from the British viewpoint, and while the author has included American practice he has of course not done so with the first-hand knowledge of an American. The illustrations and other mechanical work are also hardly up to the standard of the price of the volume.

The forty-four chapters of the book are grouped under the heads of "Continuous Handling of Material," "Continuous Handling of Material by Pneumatic or Hydraulic Means," "Intermittent Handling of Material," "Unloading and Loading Appliances," "Miscellaneous Installations" and the "Automatic Weighing of Material." Eighteen chapters under the first two groups cover all kinds of conveyors. Cableways and telphers are included in the third group.

It is in these latter groups, which are devoted to large-scale operations, in which the author gets farthest from American practice. There is, of course, many a valuable suggestion for the American engineer in the pier and mine equipment described, but he will hardly be satisfied with the small amount of space given to American grain elevators, or the total ignoring of the mammoth coal terminals on the Atlantic seaboard.

In short, the use to which the American engineer will be able to put this volume will be in the appropriating and adapting of foreign ideas. If his chief business is the designing of mechanical handling equipment, he will doubtless find the book worth the price.

Sacramento Water-Supply Report

To serve the needs of those wishing copies of the detailed and valuable report on a new water-supply for Sacramento, Calif. (abstracted in *Engineering News*, Oct. 19, 1916), a second edition of the report has been published and is for sale at $3, paper bound, and $4, cloth bound (Rincon Publishing Co., 689 Stevenson St., San Francisco, Calif.). The report was made by Prof. Charles Gilman Hyde, of the University of California, George H. Wilhelm and Frank C. Miller, the latter be-

ng City Engineer of Sacramento. It is a volume of 660 pages, illustrated with maps and drawings. It contains valuable data on various phases of water-supply in general, besides the results of extensive investigation of possible sources available for Sacramento.

Water-Supply Papers

Among recently issued Water-Supply Papers of the United States Geological Survey (Washington, D. C.) are three in the Profile Surveys Series, dealing with the "Colorado River Basin in Wyoming, Utah, Colorado and New Mexico" (No. 396; 50c.); "Rivers in Wisconsin" (No. 417; 45c.), and "Skagit River Basin, Washington, 1915" (No. 419; 15c.). Another Water-Supply Paper (No. 415; 45c.) is entitled "Surface Waters of Massachusetts." The various papers may be obtained for the prices stated, from the Superintendent of Documents, Washington, D. C.

PUBLICATIONS RECEIVED

[So far as possible the name of each publisher of books or pamphlets listed in these columns is given in each entry. If the book or pamphlet is for sale and the price is known by the editor, the price is stated in each entry. Where no price is given it does not necessarily follow that the book or pamphlet can be obtained without cost. Many, but not all, of the pamphlets, however, can be secured without cost, at least by inclosing postage. Persons who are in doubt as to the means to be pursued to obtain copies of the publications listed in these columns should apply for information to the stated publisher, or in case of books or papers privately printed, then to the author or other person indicated in the notice.]

ANNUAL REPORT OF ENGINEER AND SURVEYOR OF THE STATE OF NEW YORK, for Year Ended June 30, 1916—Albany, N. Y.: Office of State Engineer. Cloth; 6 x 9 in.; pp. 324; illustrated.

ANNUAL REPORT OF THE DOMINION (OF CANADA) WATER POWER BRANCH for Fiscal Year Ended Mar. 31, 1916. Ottawa, Ont.: Water Power Branch, Department of the Interior. Paper; 7 x 10 in.; pp. 188; illustrated.

BULLETINS, UNITED STATES GEOLOGICAL SURVEY—Washington, D. C. Paper; 6 x 9 in.

Bulletin 624, Useful Minerals of the United States—Compiled by Frank C. Schrader, Ralph W. Stone and Samuel Sanford (a revision of Bulletin 585). Pp. 412.

Bulletin 653, Chemical Relations of the Oil-Field Waters in San Joaquin Valley, California—By G. Sherburne Rogers. Pp. 119.

Bulletin 657, The Use of the Panoramic Camera in Topographic Surveying, with Notes on the Application of Photogrammetry to Aërial Surveys—By James W. Bagley. Pp. 88; illustrated.

THE BUILDING ESTIMATOR'S REFERENCE BOOK: A Practical and Thoroughly Reliable Reference Book for Contractors and Estimators Engaged in Estimating the Cost of and Constructing All Classes of Modern Buildings; Giving the Actual Labor Costs and Methods Employed in the Erection of Some of Our Present-Day Structures, Together with All Necessary Material Prices and Labor Quantities Entering Into the Cost of All Classes of Buildings—By Frank R. Walker, author of "Practical Cost Keeping for Contractors." Second edition revised. Chicago (168 North Michigan Ave.): The Author. Leather; 4 x 7 in.; pp. 3540; illustrated. $5.

THE CALCULATIONS FOR STEEL-FRAME STRUCTURES, Designed to Comply with the Requirements of the London County Council (General Powers) Act, 1909, with Notes on the Application of Theory to Practical Design—By Walter Cyril Cocking, M.C.I., M. J. Inst. E., Reinforced Concrete and Structural Engineer; Lecturer in Drawing and Design of Structural Steelwork at the London County Council School of Building. New York: D. Van Nostrand Co. London: Scott Greenwood & Son. [The Broadway Series of Engineering Handbooks.] Cloth; 5 x 8 in.; pp. 312; 78 illustrations; 6 folding plates. $2.25 net.

THE DRAINAGE OF IRRIGATED SHALE LAND—By Dalton G. Miller, Senior Drainage Engineer, and L. T. Jessup, Junior Drainage Engineer. Washington, D. C.: Office of Public Roads and Rural Engineering. Bulletin 502. Paper; 6 x 9 in.; pp. 40; illustrated.

FATAL ACCIDENTS DUE TO FALLS IN BUILDING WORK, THEIR FREQUENCY, CAUSES AND PREVENTION—Prepared by the Bureau of Statistics and Information. Albany, N. Y.: State Department of Labor. Special Bulletin No. 80. Paper; 6 x 9 in.; pp. 26.

GEOGRAPHIC TABLES AND FORMULAS—Compiled by Samuel S. Gannett. Fourth edition. Washington, D. C.: United States Geological Survey. Bulletin 650. Paper; 6 x 9 in.; pp. 388. 25c. from Superintendent of Documents. Methods and tables of value in the reduction of geographic observations. The usual connection and conversion tables in a form convenient for use by surveyors.

GOOD ROADS YEAR BOOK, 1917—Sixth annual edition. Washington, D. C. (Colorado Building): American Highway Association. Cloth; 6 x 9 in.; pp. 565. $2, postage prepaid.

Valuable, as usual, for a sketch view of highway organization, road materials and construction methods. Maps of the more prominently marked highway routes are given.

THE INDUSTRIAL ARTS INDEX: Subject Index to a Selected List of Engineering and Trade Periodicals for 1916—Edited by Marion E. Potter, Louise D. Teich and Helen M. Craig. Fourth Annual Cumulation. White Plains, N. Y., and New York City: H. W. Wilson Co. Cloth; 7 x 10 in.; pp. 530. Published February, April, June, October, December. Full information in regard to subscription price will be supplied on request.

MADRAS PUBLIC WORKS DEPARTMENT: Administration Report for 1915-16. Part II—Irrigation. Madras, India: The Department. Paper; 8 x 13 in.; pp. 272. 4 shillings.

MILK AND ITS HYGIENIC RELATIONS—By Janet E. Lane-Clayton, MD., D.Sc., Assistant Medical Inspector under the Local Government Board. Published under the Direction of the Medical Research Committee (National Health Insurance). New York and London: Longmans, Green & Co. Cloth; 6 x 9 in.; pp. 356; 8 plates. $2.50 net.

MUNICIPAL FUNCTIONS—By Herman G. James, J.D., Ph.D., Associate Professor of Government, Director of the Bureau of Municipal Research and Reference, University of Texas. New York and London: D. Appleton & Co. [National Municipal League Series.] Cloth; 5 x 8 in.; pp. 380. $2 net.

ORGANIZATION IN ACCIDENT PREVENTION—By Sydney Whitmore Ashe, B.S., E.E., chairman, Committee on Safety and Health, National Association of Corporation Schools; member, Educational Committee, and secretary of Foundry section, National Safety Council; author "Electric Railways," etc.; Head Educational and Welfare Department, Pittsfield Works of the General Electric Co. New York and London: McGraw-Hill Book Co., Inc. Cloth; 6 x 9 in.; pp. 130; illustrated. $1.50 net.

THE PORTLAND CEMENT INDUSTRY: A Practical Treatise on the Building, Equipping and Economical Running of a Portland Cement Plant, with Notes on Physical Testing—By William Alden Brown, Assoc. Am. Soc. C. E., Member South Wales Institute of Engineers; formerly Works Manager, Aberthaw and Bristol Channel Portland Cement Co., South Wales. New York: D. Van Nostrand Co. Cloth; 6 x 9 in.; pp. 168; 35 plates and numerous text illustrations. $3 net.

PREVENTION OF THE EROSION OF FARM LANDS BY TERRACING—By C. E. Ramser, Drainage Engineer. Washington, D. C.: Office of Public Roads and Rural Engineering. Bulletin No. 512. Paper; 6 x 9 in.; pp. 40; illustrated.

PRICE OF GASOLINE IN 1915—Washington, D. C.: Federal Trade Commission. Paper; 6 x 9 in.; pp. 224.

RAILWAYS IN INDIA: Administration Report for 1915-16. In two volumes. Simla, India: Secretary, Railway Board. Paper; 8 x 13 in.; pp. 540 and 602. 2 shillings 3 pence.

RAILWAY STATISTICS OF THE UNITED STATES OF AMERICA for the Year Ended June 30, 1916, compared with the official reports for 1916 and recent statistics of foreign railways—Prepared by Slason Thompson, Bureau of Railway News and Statistics. Chicago: Stromberg, Allen & Co. Paper; 5 x 8 in.; pp. 148.

RAILWAY STATISTICS OF THE DOMINION OF CANADA for the Year Ended June 30, 1916. [Printed by order of Parliament from sworn returns furnished by the several railway companies.] Ottawa, Canada. Paper; 6 x 9 in.; pp. 192. 15c.

REPORT OF THE BOARD OF RAILWAY COMMISSIONERS OF CANADA for the Year Ended Mar. 31, 1916—Ottawa. Paper; 6 x 9 in.; pp. 460. 30c.

REPORT OF THE IOWA STATE HIGHWAY COMMISSION for the Year Ended Dec. 1, 1916—Issued by the State Highway Commission, Ames, Iowa. Cloth; paper; 6 x 9 in.; pp. 321; illustrated.

SEWAGE DISPOSAL ON THE FARM—By George M. Warren, Hydraulic Engineer, Office of Public Roads and Rural Engineering, Washington, D. C. Paper; 6 x 9 in.; pp. 27; illustrated.

One of the very best pamphlets yet issued on farm privies and sewage disposal.

ST. MARYS FALLS CANAL, MICHIGAN: Statistical Report of Lake Commerce Passing Through Canals at Sault Ste. Marie, Michigan and Ontario, During Season of 1916, with a Supplementary Report of Commerce Passing Through the Detroit River—Prepared under the direction of Lieut.-Col. H. Burgess, Corps of Engineers, U. S. A., Federal Building, Detroit, Mich. Paper; 6 x 9 in.; pp. 30; illustrated.

STATE SANITATION: A Review of the Work of the Massachusetts State Board of Health—By George Chandler Whipple, Professor of Sanitary Engineering in Harvard University and the Massachusetts Institute of Technology; Member of the Public Health Council. Massachusetts State Department of Health. Vol. I. Cambridge, Mass: Harvard University Press. Cloth; 6 x 9 in.; pp. 387; 11 plates and 8 text illustrations. $2.50.

SURVEY OF NORTHERN AND NORTHWESTERN LAKES—Bulletin No. 26. Detroit, Mich.: United States Lake Survey Office. Paper; 8 x 10 in.; pp. 521.

TOWN PLANNING FOR SMALL COMMUNITIES—By Walpole (Mass.) Town Planning Committee, Charles S. Bird, Jr., Chairman. New York and London: D. Appleton & Co. [National Municipal League Series.] Cloth; 5 x 8 in.; pp. 509; illustrated. $2 net.

WATER PURIFICATION—By Joseph W. Ellms, Member, American Society of Civil Engineers, American Chemical Society, American Public Health Association and New England Water-Works Association. New York and London: McGraw-Hill Book Co., Inc. Cloth; 6 x 9 in.; pp. 485; 150 illustrations. $5 net.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Expansion-Joint Armor Plates for Concrete Road Hinged to Supporting Bridge

By GUY BONNEY

Baltimore, Md.

EXPANSION-JOINT armor plates are held in position securely and in such a way that the finisher can work clean over the joint before the support is removed by the plank bridges (shown in the photograph), which

BRIDGE AND JOINTS MADE UP TO SET IN PLACE AS UNIT

were used recently in constructing a concrete road in Baltimore County, Maryland.

The 2 x 12-in. boards, trimmed on one edge to the crown of the road, are held vertical by wood brackets on each end, which are tacked to the side forms. These brackets support the board about ½ in. above the surface of the concrete. To each board are fastened six 8-in. strap hinges, the lower ends of which project about 3 in. below the board and are punched for a ½-in. bolt. A bolt was also used to hold the upper straps to the board, the hinges being placed in pairs.

A pair of plates, with asphalt felt between, are placed between the hinge straps below the plank and spaced ½ in. from the latter with small blocks, which are removed after the nuts holding the hinges to the plates are tightened. The whole thing is then set for a joint and the brackets tacked down.

The ½-in. space allows the finisher to trowel all the way through before the bridge is removed. This was done as soon as the concrete had set sufficiently to hold the plates securely by taking out the bolts fastening the plates to the hinges and removing the bridge, after which the holes left in the concrete where the hinges had been were plugged with mortar. The contractor on this work used altogether about six of these boards.

The road in question was built by Thomas Mullan for the Baltimore City Water Department, of which Ezra B. Whitman was engineer, and for which the writer was in charge of the construction as assistant engineer.

Convert Y, Two Pieces of Hose and Pail of Grout Into Cement Gun

A PHILADELPHIA contractor has frequently used for repairing cracks and filling construction joints a home-made cement gun consisting of a reducing Y with a nozzle on one end and a compressed-air hose on the other end of the straight leg, and a smaller hose on the branch to a pail of grout. The Y is handled by one man, while another keeps the grout stirred up and the bucket full.

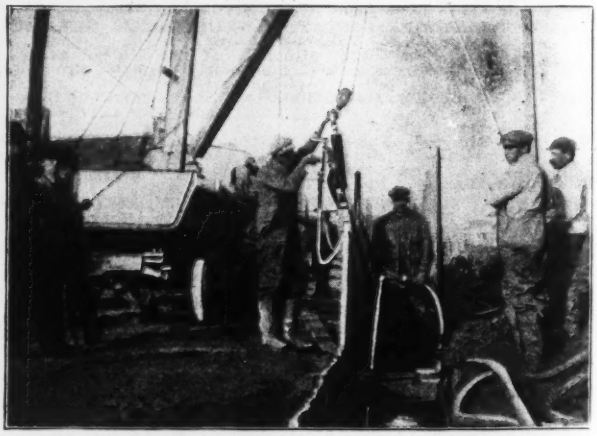
Motor Truck and Steam Roller Drive Tight Trench Sheeting

By W. DE WITT VOSBURY

Consulting Engineer, Camden, N. J.

A LIGHT HAMMER swung from a derrick mounted on a motor truck and supplied with steam by a road roller is being used to drive sheeting by the contractors for sewer work at Bayhead, N. J.

Of the five miles of sewer trench to be opened, practically half will require close sheeting. The material ex-



MOTOR TRUCK AND ROAD ROLLER PRESSED INTO SERVICE TO DRIVE 140 FT. OF SHEETING A DAY

cavated is pure white sand with ground water in great abundance. Under these conditions sand will shoot into the trench through the smallest opening, and it is necessary to drive the sheeting with very close joints and to a penetration at least 18 in. deeper than the bottom of the trench. Usually where work of this kind is not large enough to justify the installation of elaborate plant, such sheeting is driven by hand. Tight joints are difficult to secure in this way, and it is almost impossible in sand to drive the sheeting in advance of the excavation.

These difficulties were overcome in a most satisfactory manner on the work described by pressing into service the motor truck and road roller, which were already on hand, to operate the light steam hammer in the manner shown in the photograph.

The trench is first excavated about 2 ft. and a timber frame for guiding and bracing the sheeting placed in position. The sheeting is then stood up, after which the motor truck and the road roller, with the hammer, start at one end of the trench and move down the line as fast as the piles are driven. A water jet is also used to hasten the driving. With seven men an average of 140 lin.ft. of 12-ft. piles are placed and driven in a day. The cost, including equipment charges, labor and water for jetting, is approximately 27c. per linear foot.

The equipment was devised by H. W. Underwood, of the firm of Field, Barker & Underwood, contractors, who is in personal charge of the work.

Timber Bridge-Pier Caisson Launched by Tipping from Unbalanced Scow

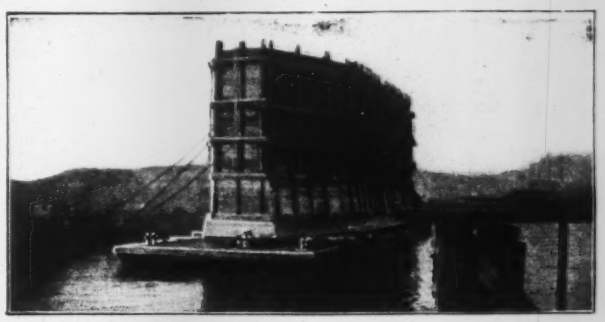
By E. J. GRODSKE

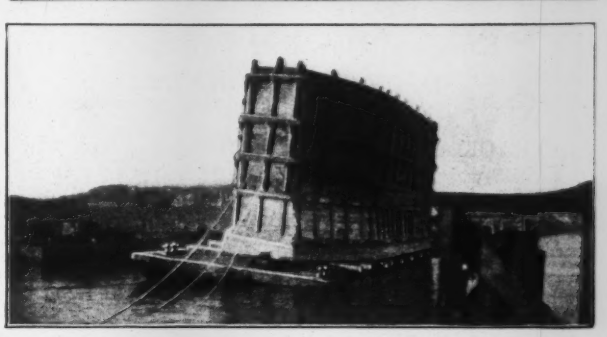
Assistant Engineer, Bureau of Public Works, Manila

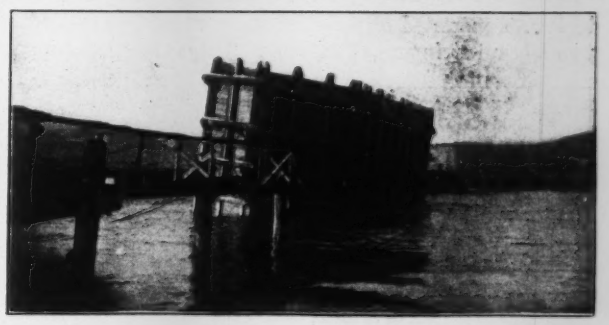
THE views in the adjoining column show the progress in one half-hour of the launching of a timber caisson for one of the concrete piers of the Jones arch bridge, at Manila, P. I. The caisson, a timber frame on a concrete base, was built on a scow arranged to permit its being tipped so as to allow the caisson to slide off and be floated to its proper location, where it could be sunk into place and the concrete pier built inside of it.

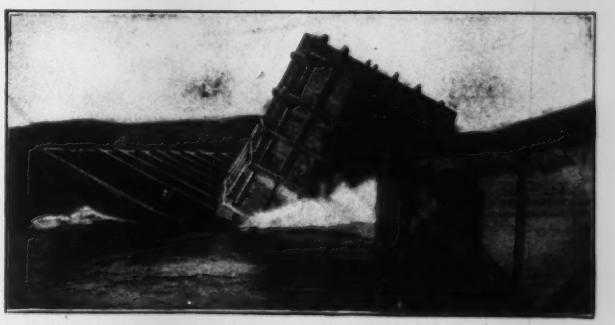
The caisson was 100 ft. long, 35 ft. wide and 36 ft. high. The walls of the lower portion of the caisson for a height of 14 ft. were battered and constructed of reinforced concrete 1 ft. thick, while the remaining height was unbattered and built of double timber sheathing and one thickness of tarred paper. Three feet above the lower edge of the caisson was a 4-in. calked plank floor supported by inverted timber trusses, which in turn rested on timber sills bolted to the upper edge of the concrete walls. The floor and trusses were designed to withstand water pressure during flotation. The scow upon which the caisson was built was divided longitudinally by a bulkhead, so that water could be admitted into one side and cause the scow to list. Between the scow deck and the caisson were pairs of skids that were well greased just before launching.

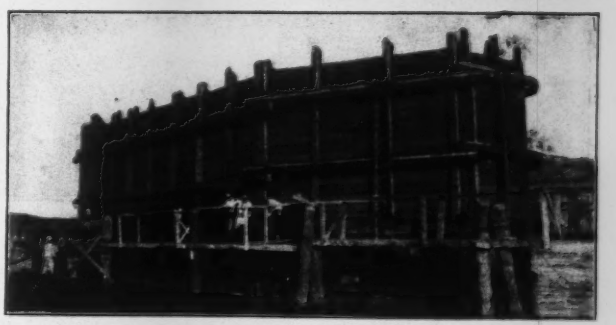
After the piles were driven and cut off, the scow with the caisson was towed to a position below the proposed pier location, and the valves on the midstream side of the scow were opened. The only lines used were those necessary to keep the caisson from floating downstream and to tow it into place after launching. Twenty-three minutes after opening the valves, when the list was about 15°, the caisson slid smoothly into the water, reaching a maximum angle of inclination, due to the momentum of the slide, of about 45°. As was anticipated, just as soon as the caisson began to slide, the scow tipped quickly and was pushed from underneath with considerable force, as shown in one of the views. Due to the low center of gravity, the caisson righted itself with long easy rolls and finally rested on an even keel at an immersed depth of 8.5 ft. The floating caisson was immediately manned, towed into











VALVES OPENED AT 6:38 A.M., CAISSON TOOK THE WATER AND RIGHTED AT 7:01—MOORED IN FINAL LOCATION AT 7:10

place and sunk by opening valves in the eight compartments into which it was divided. These divisions were made to avoid any list during the process of sinking, but no trouble whatever was experienced.

The floor and trusses will be removed by divers, to be reused for a second caisson, and a concrete seal placed in the bottom, after which it will be pumped dry and the remaining concrete placed.

The work is being done by the Atlantic, Gulf & Pacific Co., of Manila, under contract for the City of Manila.

Home-Made Five-Ton Track Crane Can Be Knocked Down in Two Hours

By HERBERT J. GILKEY

Chicago

A TRACK crane is shown in the photograph which, while weighing only 1½ tons and being easy to shift on and off the track, is able to handle a 5-ton load. It was built by George D. Carnahan, assistant master carpenter of the Chicago Terminal Division of the Pittsburgh, Cincinnati, Chicago & St. Louis Ry., of the Pennsylvania system.

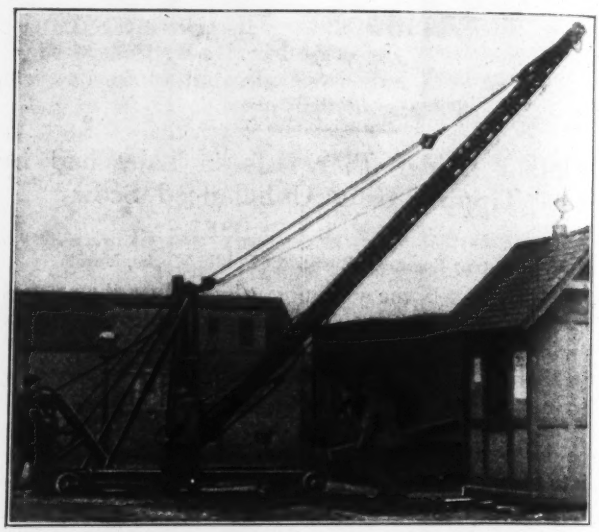
The derrick, which is made entirely from scrap materials, is mounted on four hand-car wheels, connected by two I-beam stringers 14 ft. long. These stringers support

EVEN CRABS WERE MADE OF SCRAP MATERIAL

the A-frame and the double hand crab used for hoisting. The boom is made in two sections, the full length being 30 ft. and the length with one section removed 21 ft. For anchoring the machine to the rails so that it can handle loads at the side of the track, screw clamps which fit over the rail heads and can be attached or released very quickly are used.

A small screw jack, shown in one of the photographs, is carried, and the machine is so well balanced that it can be raised, by placing this jack under the center of the A-frame, revolved 90 deg. and rolled off the track like a hand car.

The derrick has handled five tons with ease, using the short boom. With the 30-ft. boom a load of 2400 lb. has been handled at 22-ft. radius. The entire machine can be taken down and packed in a car for shipment in less than two hours. It has proved very useful in trestle



DERRICK PUT TO MANY TIME-SAVING USES

and bridge work, and for all sorts of odd purposes. The photograph shows it moving a watchman's shanty. This was accomplished by sticking a 4 x 4-in. timber through opposite window openings, lowering a chain down the chimney hole and hooking it around the timber, picking up the shanty, swinging it over the track and running down the track with it to the new location.

Stuff Cracks with Burlap and Use Motor Truck To Haul Water

A VARIETY of unexpected uses have been discovered by S. M. Billiter for his United States truck on road construction near Williamstown, Ky. On one occasion he calked the steel dump body with burlap and used it to haul water. Besides hauling excavation and bulky materials, for which it was bought, the truck is stated to have proved a great economy in transporting tools from place to place. It is also stated to have enabled this contractor to keep a full crew at work on his section while other contractors in the vicinity were suffering from a shortage of labor. The truck was out bright and early in the morning and late at night, and transported the men from town to work, about 6 miles. It has never before been alleged that automobiles were scarce in Kentucky, but to the attractiveness of this ride is ascribed the contractor's success in keeping a full gang.

EDITORIALS

Contractors as Recruiting Aids

TO ASSEMBLE quickly 10,000 men skilled in the construction, operation and maintenance of industrial and standard-gage railways is the job presented by the War Department in calling for the organization of nine engineer regiments for immediate service in France. There has been a rush of men eager to enlist, but it is significant that out of many hundred applicants who appear daily at the recruiting headquarters a very small percentage proves acceptable. To expedite recruiting at the New York station, a number of well-known contractors, headed by F. J. MacIsaac, president of the General Contractors' Association, have volunteered to aid in the selection of recruits. This action may well be followed in other localities where regiments are being formed. There is no better judge of men than the experienced contractor. He can be depended upon to sift out the unqualified candidates in the line and thus establish a sort of preferred group for the recruiting officers to pass upon.

Keep the Line Moving

THE time element in passing upon recruits for engineer regiments has a bearing other than that of relieving the officers in charge, as noted in the preceding paragraph. The man out of a job has all day to spend standing in line. The one who is at work in some skilled trade—the ideal man for the ranks of engineer troops—and has asked for half a day off to visit recruiting headquarters is looking for action. If he is forced to cool his heels for hours before any notice is taken of him he is inclined to pass up the opportunity of serving the Government at a dollar a day and go back to work for which he can easily get five times that sum. This is a point which those in charge of recruiting should constantly bear in mind. Commanding officers will find it well worth while to put into effect measures which will keep the recruiting line moving.

War the Great Accelerator

WAR is the great reformer. The observation, trite enough in these days, has fresh application in the prospective rejuvenation of the canal as a freight carrier. The prospect gains authority by the most recent statement of the railway member of the Council of National Defense, who says that the mobilization of freight carriers to meet war conditions demands the immediate maximum development of our inland waterways to relieve the congestion of track and terminal entailed by the international situation. Thus, by a familiar process, the crisis speeds up minds and conditions to a state they would normally reach in time, but slowly. The growing congestion of the railway centers in the big cities, with its attendant property problems, political complications and living condition demands, are gradually bringing to the front the necessity for utilizing what natural freight carriers there are. That the waterway, be it canal or river, properly prepared and sensibly used, will supplement the railway's value and not detract from its profits may under stress of circumstance become obvious, and the opposition to waterway competition once broken down, who can guess the probabilities of building it up to its original vigor!

Initial Stresses in Built Members

AN OLD question is set at rest by one important new structural fact developed in the Bureau of Standards' recent column tests. The discovery promises to have meaning outside of the limits of compression members.

Legitimate doubts have always existed whether a built-up steel member is not weakened by the initial stresses existing in its several components or set up in them by the process of assemblage. In a tension member, if one angle or bar contains initial tension at some point, then when the member is loaded that bar might reach its yield point before an average yield-point loading is reached for the full section of metal. This would mean reduced strength. Quite the same thing applies to compression members, obviously.

This doubt was put to a crucial experience in the extensive series of tests of built-up columns. If the presumed weakening effect exists, it must become apparent in some among the large number of tests. Close scrutiny of the results fails to disclose any reduced strength of the kind, and the conclusion is virtually demonstrated that the initial stresses have no influence on failure.

It appears, therefore, that we may disregard the initial stresses in built structural members, provided our present grades of steel are used. With hard, brittle steel, a different result might appear, at least in tension members

Do Not Stop Construction Work

THE request for information on the large share of the contracting resources of the country not yet reported to the Federal Government, which was issued on May 3 by this journal, has developed the extent of the uncertainty which prevailed as to what would become of construction work. More than one firm handling annually several million dollars worth of work has written this journal that a large number of current contracts were being wound up, and that if the Government needed their services no more work would be undertaken. These firms were, of course, advised that this journal considered it their duty to take on new work, keep their organizations together and continue their business. The primary reason for collecting the information requested was to afford the Government a much larger list than it possessed of experienced contracting firms able to undertake work in any section of the country, so that the work which the Government will require can be performed without disorganizing other engineering construction to a serious extent, and without throwing too much of a burden on a few firms or on the contracting business in a few sections

of the country. It may be that before the war is over we will have to suffer the disorganization of many other lines of business than that of new construction work. Today, however, we are not so desperately pressed that it is necessary for us to drop all development work forthwith. Canada is not yet in such straits—nor England, nor France; though all of them have felt the weight of the war far more heavily than we can feel it for some time to come. It is the duty of those with authority and influence to see that alarmists do not unnecessarily add to our dangers by inducing hysteria.

What Shall Canada Do with Her Bankrupt Railways?

WILL Canada be able to put her railways on a self-supporting basis, and if so, how? This question is an urgent one indeed. A large part of the Dominion's railway network is a bankrupt wreck, bankrupt many times over. Quick answer is needed. The United States will be very directly interested in the nature of that answer, because our railroads join up with Canada's, are physically like them, and are in competition with them—all being part of the railroad system of North America. We are interested also because we have bankrupt railroads and are hearing demands for government ownership.

As early as half a dozen years ago the question existed, though the people of Canada declined to recognize it. Yet no great prophetic vision was required to foresee that an answer must be given soon. Canada had been frenziedly building railroads for a nonexistent population and traffic—railroads carried on a shadowy financial structure propped up by government guarantees, loans and gifts. It was hardly conceivable that the structure would endure.

Finally the National Transcontinental fiasco opened the eyes of even the optimistic, politician-ridden Canadian public to the dangerous situation. But the problem has now grown beyond the power of any simple curative formula. Brutally radical measures seem to be needed, in which confiscation and repudiation are among the simpler elements. The condensed abstract of the proposed remedies, given on another page, affords a clear view of this fact, though we quote the more or less diplomatic language of the proposers.

Sympathy is due Canada for her plight, but hardly the unqualified sympathy that innocence merits. The financial madness of the past was in part the outgrowth of an honest but unreasoning optimism which could not refrain from using superlatives in estimating the country's growth. But in larger measure it is chargeable to a deadly combination of private exploitation and governmental connivance. It matters little whether this connivance was due to incompetence or to sheer dishonesty of the government officials—Canada as a whole will have to pay the penalty. None of the suggested remedies is claimed to be capable of more than a gradual restoration of solvency for the railroads; the public must continue to make up the deficits for a long time to come.

As to these remedies, one naturally thinks first of the majority and minority reports of the Royal Commission. Mr. Tye, however, formerly chief engineer of the Canadian Pacific, preceded the commission by several months with his carefully-thought-out plan, and *Engineering News-Record* believes any discussion of the situation is incomplete without consideration of his scheme.

Of the three plans, we find it hardest to accept the majority plan of the commission. Mr. Smith's criticisms of it seem conclusive. The Drayton-Acworth scheme is nothing less than government ownership and operation not very skilfully masked, and some of the commission's own arguments against government ownership, as Mr. Smith points out, condemn the scheme. In saying this we are well aware that a strong tendency exists in Canada toward approval of the majority plan and a virtual ignoring of the minority plan. But it appears that they whose minds run in this direction do not share the commission's own distrust of government operation, nor do they seem to see fault anywhere but in the misdeeds of private capital for the country's present predicament. This is a partial view of the case at best. Aside from the government's part in the troubles of the Grand Trunk and the Canadian Northern, government operation of the Intercolonial has been a dismal failure, and government operation of the National Transcontinental offers no greater promise.

Hence *Engineering News-Record* holds that the case lies clearly in favor of Mr. Smith's minority plan as compared with the Drayton-Acworth scheme. Between the Smith plan and the Tye plan it is not so easy to choose. Both have good points. The Tye plan is perhaps the more idealistic. Under it three large railroad systems under private ownership—nominally, at least, though only one of them is now solvent—would lose their identity, and it would scarcely be possible to satisfy the conflicting claims and avoid long litigation. If the plan could be consummated it would give the country a unified transcontinental system that would to all appearances have the makings of a worthy competitor of the Canadian Pacific. And it would take the National Transcontinental off the hands of the government.

Undoubtedly it would be much easier to effect the territorial adjustments between the Grand Trunk and the Canadian Northern recommended by Mr. Smith, though the holders of these properties might demur at even this proposition as too wildly radical. Under Mr. Smith's plan suitable traffic arrangements might put the several roads in almost as favorable a position to compete with the Canadian Pacific as if they were under one management, provided the Canadian Pacific could not underbid either of them for the traffic relations with the other.

Some Canadians have objected that this plan gives the rich territory in eastern Ontario and from Winnipeg west to the private interests and leaves the government with the barren link from North Bay to Winnipeg, unless either the Grand Trunk or the Canadian Northern should choose to take this link over. Because these two systems as reorganized would depend on each other for their transcontinental business—unless, as before suggested, either found it more profitable to deal with the Canadian Pacific—probably one of them would be forced to take over the connecting link. If this should not come to pass the 1000-mile link would in truth be uninviting to any third company.

And in any event the National Transcontinental would not be provided for—wherein, in our estimation, lies a fatal weakness of the Smith plan. The National Trans-

continental Ry. was a colossal mistake, at least the line from North Bay east, which is no part of the Grand Trunk ocean-to-ocean scheme, and which was appended as an afterthought. But the mistake has been made, and Canada should not be blamed for wishing to rectify it. That can hardly be accomplished by leaving the road high and dry, without terminals, feeders or traffic.

If for no other reason, Canada will doubtless reject the Smith scheme because it leaves the National Transcontinental to shift for itself. Because the Tye scheme takes care of this child of the popular fancy; because it makes sure that the different lines now in distress will work for and not against each other; and because withal it adheres to private management in a line of endeavor where there is no precedent to show that government operation on a large scale, under any cloak, would succeed—Mr. Tye's plan seems to *Engineering News-Record* more commendable than either of those proposed by the members of the Royal Commission.

Revolution or Reform in American Water-Works Association?

LAST week's doings at Richmond showed the American Water-Works Association at its worst and at its best. For a time it seemed as though unprogressive elements had prevailed. Then righteous indignation waxed hot, despair turned into determination and all except the most deeply injured and rebuffed of the men who have fought so long and hard for the Association's upbuilding—morally, financially, and technically—heaved a sigh, shouldered their burden and again pressed forward and upward. Meanwhile there were signs of chastening and repentance in other quarters. Then both sides began to see that the victory of reaction was more apparent than real; that notwithstanding the methods used by a few members and the injustice done to faithful servants of the Association, other good and true men had been put in office. Still later came the linen washing described elsewhere in this issue. This was a thorough enough job as far as it went, but the participants were too few and some bad stains were left that only the sunshine of truth, frank confession, full repentance, and future good works can remove—for all of which there is reason to hope.

Frankness compels us to say that although the note we have attempted to strike in the foregoing paragraph is hopeful yet the outlook is still heavily overshadowed by dark clouds. What these are may be learned in more detail than can be given here by referring to the convention report elsewhere in this issue and by going back two years to the editorial entitled "Can the American Water-Works Association Find Itself?" (*Engineering News*, May 20, 1915, p. 994.) In the issue named, after speaking of recent progress of the Association due to "arduous work on the part of a few," it was said:

"Notwithstanding all this gain, the Association has not yet wholly found itself. It has cast off much of the levity and all of the semi-official sanction of dissipation which so nearly wrecked it at the age of twenty-one. It has abandoned the financial looseness and happy-go-lucky customs which sapped its strength at from twenty-five to thirty years of age. But it has not yet decided whether it wants to be a united brotherhood of water-works superintendents or a technical society."

The doings of the past year and the apparent underlying motives might at first thought seem to be an answer to the question raised two years ago—an answer to the effect that the Association is at last finding itself, but on one of its lower levels of past years. But as we have already indicated, we prefer optimism to pessimism and think there is ground for the brighter instead of the darker view. We have faith to believe that the Association will go forward rather than backward: up not down: and that it will maintain, yes, advance, its rank among the national technical societies of the country, instead of becoming "a brotherhood of water-works superintendents."

Unfortunately some of the superintendents, or more specifically those who delight in calling themselves "practical" water-works men, have shown themselves altogether too willing to be beneficiaries instead of workers, takers instead of givers. They cheerfully let the manufacturers provide exhibits and entertainment; they let the engineers and other technically trained men provide the technical program, and grumble at the result; and they trust the finances to luck or to the small band of devoted members recently kicked—some down and some out.

We think the Association is now in a way to find itself, and that on a higher plane than ever before. How can the process be hastened? Let us attempt to paint a few signboards pointing the way along paths that have already been or should immediately be entered.

First, it should be agreed that the American Water-Works Association is a national technical society with a real reason for existence. That being so, then the technically trained men must cheerfully be given the place on the program that they have had to take amid grumbling in the past.

The business and financial affairs of the Association must continue to be administered in the firm way they have been handled for some years, instead of the happy-go-lucky deficit-producing way of old. All this will demand clear-headed firm action on the part of the Executive, Finance, and Publication Committees, which there is good reason to expect. It will also demand the willing support of the rank and file of the membership. That, too, may be hoped for.

The Constitution may need thorough overhauling. Certainly the nominating machinery needs to be rebuilt. Most emphatically, the political nominating and electioneering methods of the past year must be forever abandoned and faithful, hard administrative work not again rebuffed.

Time was when the formation of an engineering section might have been seriously considered. That day is past. The association is now a technical organization. Water-works administration is no longer a matter for "practical" men and politicians, but is a full-sized job for the best educated and most highly trained engineers and other scientists, business men, and financiers that the country affords.

Finally, there should not be a moment's delay in acting on the fact that the future of this Association of 1350 members demands the entire time of one strong well paid executive officer. The finances of the Association seem to warrant a liberal expenditure to this end—even to the extent of drawing on the surplus fund, if that be necessary.

LETTERS TO THE EDITOR

Comment on Matters of Interest to Engineers and Contractors Will Be Welcome

Financing Water-Supply and Sewerage Connections and Plumbing

Sir—I read with interest the article in *Engineering News* of Mar. 22, 1917, on "Financing Water-Supply and Sewerage Connections and Plumbing." In the Province of Ontario "Public Health Act" there is the following section:

"Where a local board in any city recommends that sanitary conveniences should be installed in any building, and is of the opinion that the owner is unable to pay the expense of the same at once, the municipality may install suitable sanitary conveniences at the expense of the owner, and the board may direct that the cost, including interest at 5% per annum on the deferred payments, be paid by the owner in equal successive annual payments extending over a period not exceeding five years, and that such annual payments be added by the clerk of the municipality to the collector's roll and collected in like manner as municipal taxes."

This plan is working out very well. In Toronto, a city of 450,000 people, advantage is taken of this section very frequently, especially by the foreigners. The clause gives the medical health officer a larger opportunity for enforcing his rulings as to cleanliness, sanitation, etc., in the congested sections of the city.

E. M. Proctor,
With James, Loudon & Hertzberg, Ltd.,
Toronto, Ont. Consulting Engineers.

Show Students How To Observe

Sir—The discussions that have appeared on "Should Not Engineering Teachers Know How To Teach?" and "Should Not Engineering Students Be Taught How To Study?" need to be rounded out by one on "Should Not Students Be Shown How To Observe?" The writer has been employing college-bred engineers for some 17 years, and his experience has been that the main trouble with them is, they have not been taught how to observe. The following illustrations, taken entirely from experiences with college men, show what is meant:

One man's notes would indicate that no other trees grow in our woods except elm. At any rate, all his benchmarks were on "elms," though many of his "elms" were mulberry and cottonwood.

Another's transit notes revealed the curious fact that he had run a line through 160 acres of asparagus, which later in the season, when harvested, gave 24 bushels of wheat to the acre.

A third, when setting up camp 12 miles from civilization, dispatched a negro post-haste to wire the boss that the tent ridge-pole was broken, unmindful of the facts that he was surrounded by virgin timber and had an ax.

A fourth, a graduate of a famous Eastern university as well as of a well-known school of mines, when sent out as a masonry inspector, staked out and drove sheet piling for a bridge pier with the "nose" headed downstream.

Another, a former instructor in an Eastern university, when sent to set slope stakes for a levee, thought they were intended to "line up," which they did, with rather disastrous results to the side slopes.

In all the instances above cited the men were well grounded in mathematics, but none of them were nearly as observing as the average three-year-old child. It strikes the writer that their training was deficient somewhere. It seems clear that a man trained to be observing, even if deficient in mathematics, will in the long run be more of an engineer than a mathematician going through the world with blinders on. A. D. Millard.

Beardstown, Ill.

Broken Old Concrete Not So Good as Concrete Aggregate

Sir—In *Engineering News-Record*, Apr. 19, 1917, p. 142, the article by Clark R. Mandigo on the use of the old natural cement-concrete bases for aggregate in new paving foundations contains two comparative tables which tend to show that the resulting concrete is just as strong as when freshly broken stone is used.

The old base has been used for aggregate in such a large proportion of the 1:3:6 foundation concrete in the last five or six years here in Kansas City that comparatively few typical cylinder tests have been made of 1:3:6 concrete containing freshly broken stone. Of the six tests shown in Table II, the first four are defective; Nos. 204 and 208 both contain old aggregates, No. 209 was a wet mix, and the aggregate in No. 210 was "1½-in. crusher run not very uniform," while the other sets of test cylinders contained larger stone. The remaining two tests in this table had an average strength at 90 days of 1600 lb. per sq.in., as compared with 1312 lb. in Table I. However, only two sets of tests are not sufficient data upon which to make a dependable comparison of this kind.

Further tests will throw more light on this subject, but this corrected comparison is in accordance with the judgment of practically all the present members of the engineering department, that the use of the old base results in a concrete of only two-thirds to three-fourths of the strength of concrete where new materials are used throughout.

In practically all the tests on concrete containing old base aggregate the fractures occurred along sections containing a large percentage of the old natural cement mortar, and the tests are not very uniform on this account; and the same statement must also necessarily hold true as to the strength of the paving foundation laid in the street.

Outside of this comparative strength of the concrete, we indorse Mr. Mandigo's conclusions on this practice, even though it results in a continual source of trouble for the engineering department.

Robert S. Beard,
Kansas City, Mo. Assistant City Engineer.

THE ENGINEER IN FIELD AND OFFICE

A Department Devoted to Details of the Day's Work

White Paint Saves Gasoline

By HENRY A. GARDNER

Assistant Director, Bureau of Industrial Research, Washington, D. C.

IN CONSIDERING the effect of the different types of rays of which light is composed, it is found that the calorific, or heat-producing, rays are conducted by painted or finished objects in widely varying degree. This fact should be studied. When black or dark-colored paints have been used in painting large tanks containing light distillates, rapid absorption of heat takes place, and considerable losses by evaporation are apt to occur. White or light-colored paint should therefore be used for the finishing coats on oil-storage tanks. Paints presenting a high gloss are, moreover, less absorptive of thermal rays than those presenting a matte surface.

RISE IN TEMPERATURE OF BENZINE CONTAINED IN SMALL TANKS PAINTED IN VARIOUS COLORS (GLOSS FINISH), WHEN SUBJECTED TO RAYS OF CARBON ARC FOR PERIOD OF 15 MIN.

Color	Rise in Deg.
Tin plate	19.8
Aluminum paint	20.5
White paint	22.5
Light cream paint	23.0
Light pink paint	23.7
Light blue paint	24.3
Light gray paint	26.3
Light green paint	26.6
Red iron oxide paint	29.7
Dark prussian blue paint	36.7
Dark chrome green paint	39.9
Black paint	54.0

Since, in the writer's experiments, white paints faintly tinted have given substantially the same heat-reflecting properties as white paints, the former should be given the preference, as they are more restful to the eye and more durable on long-time exposure.

Ditch Flow Found Quickly and Accurately with New Portable Weir

By EDWIN S. FULLER

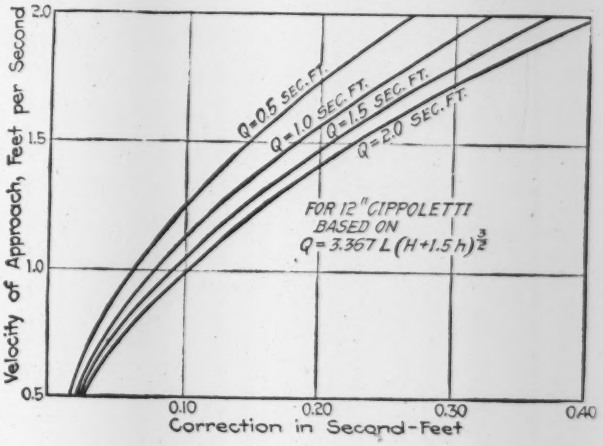
Hydraulic Engineer, Washington, D. C.

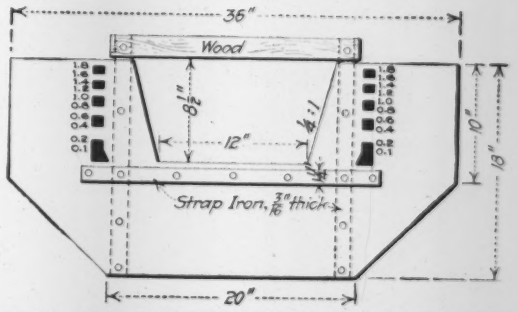
BY THE use of a portable weir weighing about five pounds, not only the accuracy but also the speed of seepage investigations was increased, and measurements of the seepage losses along a canal were made almost as fast as the hydrographer could walk along the bank. Also, by the aid of these weirs, the hydrographers and ditch riders were frequently able to settle disputes among water users and adjust the flow in small laterals not provided with measuring devices. This weir was devised by the writer for the determination of seepage losses in the canals and laterals of the irrigation project of the Twin Falls North Side Land and Water Co., Jerome, Idaho, the current-meter method first employed consuming too much time, and the flows over wastes being too small to be effectively measured in this way.

Gages Read Easily

The weir notch was of the Cippoletti form and had a capacity of 2 sec.-ft. Gages are painted on the upstream face, one on each side, so that the crest could be set level. These gages, graduated to give the readings in second-feet, can be read easily to the nearest 0.05 sec.-ft. Each hydrographer was provided with one of these weirs, which he carried with him all the time.

Nearly always some place can be found on any ditch carrying less than 2 sec.-ft. where a portable weir can easily be pushed down into the bed of the ditch until the crest is within an inch or so of the downstream water level. For quantities of water greater than about 0.5 sec.-ft., however, it is not usually possible to back up a pond large enough to eliminate velocity of approach, so





COST $2—AND IS BETTER THAN A CURRENT-METER

that it becomes necessary to correct the gage reading. To facilitate this a series of curves were computed showing the corrections to be applied for various velocities of approach. These correction curves, shown herewith, give the second-foot correction to be applied, and were scribed on the downstream face of the weir itself.

Can Be Used with Small Flows and Low Gradients

The area of cross-section of the channel about 2 ft. upstream from the weir was roughly estimated and the velocity of approach calculated mentally. The corresponding correction was then added to the weir gage reading to give the correct discharge. In this way it was found that quantities varying from a few hundredths of a second-foot to a little over 2 sec.-ft. could be measured in a minimum of time and with accuracy well within the required limit.

Occasionally when the flow of the ditch was small and the gradient low, it would take some time for the pond

back of the weir to fill, and it would be several minutes before a convenient and steady flow was attained. In such cases it was found advisable to put in a water level mark, usually a straw or twig, a few feet below the place chosen, before inserting the weir. The weir was then pushed down just far enough to shut off the flow. As soon as the pond had reached a suitable size, the weir was pushed down slowly until the water in the ditch below reached the reference mark. The gage was then read. This procedure not only increased the speed of operation, but it secured the measurement of the correct amount of water.

Costing at present prices about $2, these weirs are far superior to current meters for the measurement of small quantities of water. In the writer's opinion, they should be made a part of the equipment of every ditch rider and hydrographer on irrigation projects.

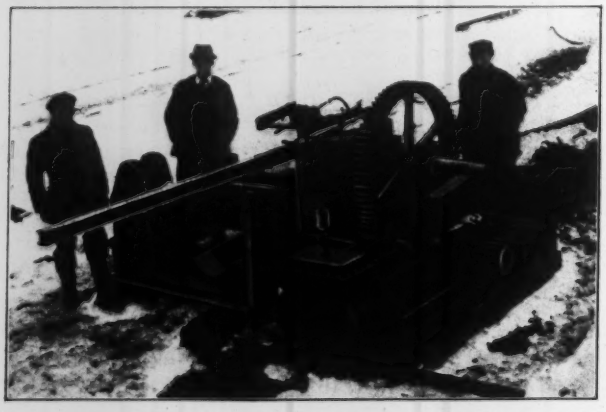
To Prevent Volume-Change of Wood

Pieces of air-dried wood were treated in a variety of ways by the Forest Products Laboratory to determine the best methods of retarding their absorption of moisture from the air and loss of moisture when placed in dry air. Specimens were treated with paraffin, impregnated with sugar, heated at high temperature, painted, varnished, coated with bakelite, impregnated with creosote, etc. Curves have been drawn showing the relative shrinkage and swelling which took place in these boards when exposed over a period of a year to atmosphere containing various humidities. The most effective results were secured by coating the wood with paraffin. Excellent results were also obtained from high temperature treatments and by impregnating the wood with sugar.

Rail Straightener Made from Junk

By JAMES GARLAND
Master Mechanic, Electro Products Company, Shawinigan Falls, Que.

THE photograph shows a rail straightener made from an old deck casting from a 70-ton Bucyrus shovel, an old shipper engine and some old gears. The screw, of



CROOKED RAILS SALVAGED WITH MISCELLANEOUS JUNK

4-in. diameter and ½-in. pitch, is driven by the engine, using compressed air at 75 pounds.

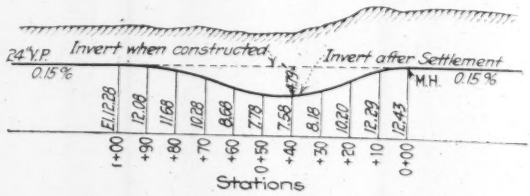
Two men can easily straighten a very crooked rail in 15 min. The machine is still in use and doing good work.

It Pays To Calk Sewer-Pipe Joints Under Certain Conditions

By T. V. STEPHENS
City Manager, Cadillac, Mich.

MANY continue to construct storm sewers with open joints, basing their practice on the theory that a sewer is to remove surface water and that there is a further advantage gained by allowing all the water possible to enter the sewer by seepage through the open joints.

For some time the City of Cadillac has experienced difficulty in discharging the storm water through a 24-in. sewer that carries the surface water from a portion of the city. Several had "satisfied" themselves that it was be-



OPEN JOINTS CAUSED THIS SEWER TO SETTLE

ing blocked by the accumulation of tar from the local gas plant, which discharged its waste water near this point. A thorough investigation made during the past winter showed the necessity of digging up the sewer. A profile taken of the sewer as found indicated that there was a vertical settlement of 4.79 ft. at a distance of 40 ft. from the manhole on an intersecting street. No variation horizontally was noted.

The sewer was laid on a small grade through low sandy soil. Due to the fact that it received a large amount of water during storms and spring thaws, there was a head of water sufficient to force through the open joints. The intermittent rise and fall of water surrounding the pipe washed sand through the open joints into the sewer. This process, continued for a period of years, has caused the pipe to settle, thereby increasing the openings in the joints and completely undermining the sewer until it had settled more than two and one-third times its diameter.

Some lengths of the pipe were nearly filled with sand, but no evidence of an accumulation of tar was found. Most of the pipe was removed from the trench and relaid with joints calked with oakum and filled with cement mortar.

Tar Paper Pasted on Factory Concrete Floor Deadens Noise from Trucks

To deaden the noise from passing trucks rumbling over a concrete floor, a factory in Norwich, Conn., has successfully used a heavy tar paper pasted to the floor by paint. The method of application, as described by David Fliegelman, of Norwich, is as follows: The floor or aisle to be protected is first given one coating of a gray cement paint. On the following day, when the paint is thoroughly dry, a second coat is applied. At the same time one side of a five-ply tar paper is painted; and when both paper and floor are still wet, the paper is carefully laid wet side down on the floor and rolled with either a roller or wide-tired truck until all signs of air pockets beneath the paper disappear. The surface seems to improve with age and very effectively reduces noise at a low cost.

NEWS OF THE WEEK

Current Events in the Civil Engineering and Contracting Fields

War Forces the Abandonment of Annual Meeting

Civil Engineers, Scheduled To Meet June 12-15, Notify Members of Change

As recently as May 3 all members of the American Society of Civil Engineers received a circular concerning the forty-ninth annual convention of the society, which was to have been held at St. Paul and Minneapolis, Minn., June 12 to 15, 1917. All information concerning the convention, general program, etc., was given in some detail. Up to that date the preparations for holding the convention had gone on, although there was some doubt as to whether there would be an adequate attendance. On May 7 the War Department authorized the formation of nine volunteer engineer regiments for immediate service in France, and this action has forced a realization of conditions affecting the members of this society.

Executive Committee Acts

In this emergency the Executive Committee, which is authorized to act for the board of direction on urgent questions, was called together, and after careful discussion of the situation decided unanimously that the wise course to pursue was to abandon the convention of 1917. The following resolutions were unanimously adopted:

"Resolved, That in view of the present condition of war, which involves the absence of many members of the society in the service of their country, that the annual convention, which it had been decided to hold at St. Paul and Minneapolis, June 12-15 (inclusive), be abandoned, and that the membership be notified at once by a circular giving the reasons governing the Executive Committee in its action.

"Resolved, That it is the sense of the Executive Committee that the next annual convention of the society should be held at St. Paul and Minneapolis, provided it is the desire of the membership in that locality, and that thereafter the rotation of the place for holding the convention in the various districts be maintained as heretofore arranged."

Attendance Would Be Small

In addition to the reason given in the above resolutions, the replies already received to the convention circular, as well as numerous interviews with members of the society in the East, make it practically certain that, if the convention were held as scheduled, the outside attendance would be very small. Several of those who had stated that they would not attend have indicated that existing conditions prevented them. Quite a number of other organizations which hold annual conventions have taken similar action.

Wash Linen at Water-Works Convention

Society Politics Revealed at Richmond Meeting of Water-Works Association—Superintendents' Day Saved by Engineers—Pipe Users and Makers Deadlock

Washing linen was the leading feature of the convention of the American Water-Works Association at Richmond last week. The immediate cause of this laundry work was alleged dirty politics in connection with the letter ballot for election of officers. The real cause is of long growth, deep-rooted, and threatens the vitality and usefulness of the Association.

On May 8 it was announced that C. R. Henderson, Davenport, Iowa, had been defeated as vice president in the letter ballot by the filing of a petition, unknown to him, at the very latest possible moment, to make him a candidate for president—against Theodore A. Leisen, Detroit, the regular nominee. Mr. Henderson sent out 1200 post cards stating that he was not a candidate, but nevertheless sufficient votes were cast for him as president and diverted to A. W. Cuddeback for vice president to elect the latter by 33 votes. This and other election returns (given in detail farther on) produced an Executive Committee which chose George A. Johnson, New York City, as chairman of the Finance Committee and thus ex officio member of the Executive Committee, displacing H. E. Keeler, who had held the offices just named since 1908 and changed a large deficit into a much larger surplus.

A Tense Dramatic Hour

Though common talk in private, the true inwardness of this action and its reaction on various members and committees did not come out on the convention floor until the night of May 10. Then Mr. Morgan, of the Finance Committee; John W. Alvord, chairman of the Publication Committee; Mr. Henderson and Secretary John M. Diven gave the Association the most tense and dramatic hour in all its history.

The hour began with a written personal statement by H. B. Morgan, of the Finance Committee, who said that the report of the committee showed a net cash gain of $2139 for the year and total cash and invested funds of more than $9000. At the New Orleans meeting, Mr. Morgan said, a platform appeal to wipe out a deficit was made by S. J. Rosamond, Fort Smith, Ark. The credit for most if not all this good work, Mr. Morgan continued, was due to Mr. Keeler, and now that Mr. Keeler had been asked to turn over the work a vote of thanks was due him. (Given.)

Why Alvord Resigned

The next scene was the resignation of John W. Alvord as chairman of the Publication Committee. The results of the election, he said, indicated a feeling "that those fellows out West have too much to do with the affairs of the Association. This is true. We have done a lot. When we took hold the Association was in debt. The hat had been passed three times. The Publication Committee set out to bring this to an end. It has trimmed the proceedings down to matter worth putting on record and saved money thereby. The policy of my good friend the secretory," Mr. Alvord said, "has been just the contrary. All the way along we have had to contend with his desire to print everything everyone sent in, produce a thick volume, and make everyone happy. You would be surprised to

To Build 1500 Dwellings at Steel Company's Plant

Thompson-Starrett Co. Gets Contract for Big Industrial Development of Bethlehem Co.

In addition to the industrial town development at Sparrows Point, Md., described in the news columns of "Engineering News-Record" last week, page 330, the Bethlehem Steel Co. has recently closed contracts calling for the construction of 1500 workmen's dwellings at Bethlehem and South Bethlehem, Penn. The work has been awarded to the Thompson-Starrett Co., of New York City, and according to the contract requirements must be finished by Jan. 1, 1918.

To accommodate the new buildings a plot of several hundred acres has been acquired, which will be improved by the construction of streets, sewers, a water-supply system, etc. While the detailed plans of the laborers' houses are not yet available, the structures will contain from six to eight rooms; in the designs provision will be made for the arrangement of the rooms in such a way as to make it convenient for each house owner to take in boarders.

Gibbs and Darling Also To Go to Russia on R.R. Work

In addition to the railroad engineers mentioned in the issue of May 10, p. 331, as members of the special commission to be sent to Russia to help reconstruct that nation's transportation system, W. L. Darling, chief engineer of the Northern Pacific Ry., and George Gibbs, consulting engineer of the Pennsylvania R.R., have been recently named.

know how many people wish to exploit the Association for their own ends."

Play Politics To Oust Henderson

The false light in which he found himself at the convention was explained by Mr. Henderson in dispassionate terms, and the proceedings that put him there were scathingly characterized by Mr. Morgan. Mr. Henderson had responded to a call for a report of the Committee on Revision of the Constitution of the Association. There was no report to make, but he went on to say that the 1913 constitution needed revision; that it has not worked well, although the committee which framed it thought it was democratic.

Mr. Henderson then stated that nominating him for the presidency after he had already been nominated for the vice presidency was not done to honor him; that some of his friends thought he was responsible for it and could not understand it; and that he would like in some way to have the records cleared on the books. He thought he knew who was responsible.

J. N. Chester said it would be only fair to bring out the plain facts as to the machinations of those who put up the job to defeat Mr. Henderson for the vice presidency.

Mr. Morgan then declared that he had been in all sorts of politics, but had never seen anything so rotten as this action. Letters were actually sent out asking members to vote for Mr. Henderson as president when he had already been nominated for vice president. A large number of those who voted for Mr. Henderson as president voted for his vice presidential opponent.

It was voted that the discussion of the hour, condensed but not altered in sense, be prepared by the editor and sent to all the members of the Association.

Story of Nomination and Election

Until the members get the fuller report just mentioned the foregoing must do as regards the linen washing. The story of the nomination and election follows.

(Continued on p. 378)

General Bixby Back in Harness

Brig. Gen. William H. Bixby, retired, former chief of army engineers, will be recalled to active duty as president of the Mississippi River Commission, with station at St. Louis, succeeding Col. Curtis McD. Townsend, who has been detailed to command one of the new engineer regiments to be sent to France.

Elected President of Water-Works Association

Born in Philadelphia, Penn., Feb. 17, 1867, several years of railroad construction and management and general practice in United States and South America constituted the first engineering work of Theodore A. Leisen, who was elected president of the American Water-Works Association at the recent convention held in Richmond, Va., but

THEODORE A. LEISEN

for the last 20 years he has been engaged in municipal engineering work, sewers, parks, streets and water-works. Since 1902 he has devoted his attention exclusively to hydraulic engineering, filtration and water-works in g[illegible], occupying the position of cons[illegible] engineer and chief engineer and s[illegible]-intendent for the water departm[illegible]t Wilmington, Del., for about six [illegible]. From 1908 to 1914 inclusive h[illegible] chief engineer and superintende[illegible] for the Louisville Water Co., Loui[illegible], Ky., and also acted as consulting [illegible]-neer for the Frankfort Water [illegible]., Frankfort, Ky. From 1914 to date [illegible]r. Leisen has been general superinte[illegible]t for the Board of Water Commissio[illegible]rs of the City of Detroit.

While in charge of the water-w[illegible]s at Wilmington, Del., a new pump[illegible] station and equipment, reservoir, wa[illegible] tower, filtration works and other por-tions of the improvements to the water-works of that city were designed and built under his direction. At Louisville, Ky., he superintended the construction of the coagulating basin and designed and superintended the construction of the forty-million-gallon extension of the filter plant, the intake tower, a new office building and other minor features.

Mr. Leisen is a member of the American Water-Works Association, a member of the American Society of Civil Engineers, president of the Detroit Section of the American Society of Civil Engineers, a member of the American Society of Mechanical Engineers and a member of the New England Water-Works Association. He was president of the Engineers' and Architects' Club of Louisville, Ky., in 1912-1913.

Mechanical Engineers To Hold Spring Meeting

The spring meeting of the American Society of Mechanical Engineers will be held May 21-24, in Cincinnati, with headquarters at Hotel Sinton. The regular professional session of the society is scheduled for Tuesday—Wednesday being devoted to a joint meeting with the National Machine Tool Builders' Association, the papers dealing entirely with the production of munitions. On Thursday, the last day of the meeting, three simultaneous sessions will be held, dealing separately with gas power, industrial safety and munitions.

VIRGINIA COUNTRY CLUB ENTERTAINS WATER-WORKS ASSOCIATION

John Fritz Medal Presented to Dr. H. M. Howe

The John Fritz Medal—awarded in January, 1917, to Dr. Henry Marion Howe for his "investigations in metallurgy, especially in the metallography or iron and steel"—was formally presented in the auditorium of the United Engineering Building, 29 West 39th St., New York City, at 8:30 p.m., on Thursday, May 10. Ambrose Swasey, chairman of the John Fritz Medal Board of Award, presided, and addresses were delivered by Dr. Rossiter W. Raymond, secretary emeritus of the American Institute of Mining Engineers; Dr. Ira N. Hollis, president of the American Society of Mechanical Engineers, and Judge Elbert H. Gary, chairman of the board of the United States Steel Corporation.

Prof. Albert Sauveur, chairman of the board at the time the award was made, presented the medal, and the ceremonies concluded with the response of Doctor Howe.

The John Fritz Medal is awarded from time to time for notable scientific or industrial achievement, and is provided for in a fund subscribed in memory of the great engineering pioneer, John Fritz. The award of the medal is made by a permanent board of award composed of four members from each of the four societies: The American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers.

The members of the board for 1917 are: For the A. S. C. E., George F. Swain, Charles Warren Hunt, Charles D. Marx, Clemens Herschel; for the A. S. M. E., Ambrose Swasey, John A. Brashear, Frederick R. Hutton, John R. Freeman; for the A. I. M. E., E. Gybbon Spilsbury, Charles F. Rand, Christopher R. Corning, Benjamin B. Thayer; and for the A. I. E. E., C. O. Mailloux, Paul M. Lincoln, John J. Carty, Harold W. Buck.

Sewage-Disposal Site Controversy in Court

A temporary injunction has been granted and hearings are now being held on an application for permanent injunction to prevent sewage-treatment works being located on a site chosen for that purpose by Hanover Township, Pennsylvania. This township is on the Susquehanna River, just below Wilkes-Barre. For several years the State Department of Health has been trying to induce the City of Wilkes-Barre and Hanover Township to build joint works—as dictated by natural conditions and to reduce overhead expenses. The site for such joint works should naturally be located in the township.

Tired of waiting for the city, the township made application to the department for approval of plans for sewers to be located on a site within its own territory adjoining a public highway leading to a bridge crossing the river. This site was in close proximity to many houses. The department objected to the site and suggested that the works be located 800 ft. to the north, in the center of a large open field partly covered with water during flood stages of the river. Accordingly, new plans were prepared and submitted for approval. The owner of property adjacent to the new site contends that the location of the plant at that point would reduce the value of the property, as he contemplates erecting buildings nearby at an early date. On the strength of this contention the temporary injunction already noted was granted. It is reported that the city officials, Chamber of Commerce and City Planning Commission of Wilkes-Barre oppose the site, which is said to be within a half-mile of the city.

To Complete Turkey Creek Diversion Project

Rosedale, Kan., Kansas City, Mo., and Railways Coöperate in Flood-Prevention Work

After seven years of discussion the money has been raised and legal arrangements made for the completion of the Turkey Creek diversion project in Rosedale, Kan., and Kansas City, Mo. The final step was taken on Mar. 7, 1917, when Kansas City, Mo., accepted the Rosedale contract.

Turkey Creek rises in Kansas and flows northeasterly through Rosedale, Kan., into Kansas City, Mo. Here it receives the flow of the O. K. Creek sewer, which drains about 24 sq.mi. of land, including a large portion of the business section of Kansas City, Mo. Turkey Creek then crosses again into Kansas (this time into Kansas City, Kan.) and empties into the Kaw River, which is only a couple of hundred feet distant from the state line at this point. The drainage area of Turkey Creek before it enters Missouri is about 25 sq.mi., making a total drainage area for this stream, including O. K. Creek Valley and other tributaries, of about 56 sq.mi. The land in the Turkey Creek Valley in Missouri is owned principally by the railroads and stockyards, except that a reservoir and a high-pressure pumping station for the municipal water-works occupy considerable space along one bank.

HELPS BOTH CITIES

The Kaw River has been leveed along both banks except, of course, across the mouth of Turkey Creek. This makes the creek and adjoining lands subject to overflow from flood backwater in the Kaw River. Turkey Creek is also subject to sudden rises and freshets

Diversion Dam Suggested

In 1910, L. R. Ash, then city engineer, suggested a diversion of Turkey Creek in Rosedale, Kan., by a dam, a short new channel and a tunnel through a hill known as Greystone Heights to a new outlet in the Kaw River about 1¼ mi. above the present mouth. The total length of the diversion would be only about 2000 ft., of which 1200 ft. would be in tunnel. The chief difficulty with this plan was mainly of a legal nature. All this work would be done in the State of Kansas, and yet practically the only benefits would come to property in Missouri. Although enabling acts were passed by both legislatures, and the Kansas City charter was amended to permit the city to do work in Kansas and tax property in Missouri for the cost of the same, there were many stumbling blocks and it was apparently impossible to carry on the work as a special-tax proposition.

On Dec. 7, 1916, however, Kansas City, Mo., entered into contract with the Kansas City Terminal Railway Co., the Atchison, Topeka & Santa Fe Railway System, the Chicago, Burlington & Quincy R.R., the Missouri, Kansas & Texas Ry., the St. Louis & San Francisco R.R., the St. Louis & Kansas City Land Co., the Kansas City Stock Yards Co. and the Kansas City Connecting Railway Co., by which they each agreed to pay $22,500 per acre for the land reclaimed by the diversion of the creek, and in addition to grant a right-of-way for a storm and sanitary sewer designed to care for the drainage from the valley below the diversion dam. The diversion must be made and the lands reclaimed by Jan. 1, 1920. This contract makes funds amounting to $257,098 available from these corporations. The city has appropriated $214,402 out of a bond fund, making available a total of $471,500, the estimated cost of the diversion work.

Contract Approved

The contract approved Mar. 7, 1917, provides that Rosedale shall let all construction contracts and carry the work to completion; appoints L. R. Ash consulting and supervising engineer; appoints attorneys and provides the method of paying out the money. Condemnation of the land for the new channel and tunnel is progressing, and it is probable that actual construction contracts will be let this summer.

The dam will be of earth. The channel and tunnel will be lined with con-

crete. The tunnel will be 23 ft. in diameter. Rosedale will spend an additional $125,000 in straightening the channel and building walls along Turkey Creek about the diversion. Kansas City will build a storm and sanitary sewer along the approximate present bed of Turkey Creek in Missouri, which will pick up the present O. K. Creek sewer. The latter at its outlet has a double box section, approximately 15 x 15 ft. clear in each section, so the new sewer will of necessity be even larger. The sewer construction is estimated to cost over $1,000,000 and will be paid for, as is customary in Kansas City, by a special tax against all the land draining into it. Plans are in preparation for the sewer work, although work cannot be actually started until the diversion is completed.

Water-Works Convention

(Continued from p. 376)

First of all, it should be noted that a majority of last year's nominating committee (E. E. Wall, George A. Johnson, Frank C. Jordan, H. Hymmen and George W. Batchelder) put up the following ticket for 1917-18 officers: President, Theodore A. Leisen; vice president, Charles R. Henderson; treasurer, John C. Trautwine, Jr.; trustees, Beekman C. Little and Henry B. Morgan.

Mr. Trautwine declined to run as treasurer and rival candidates all along the line were put in nomination by petition, as follows: President, Mr. Henderson, as already explained; vice president, Allan W. Cuddeback; treasurer, James M. Caird (who had held the office for many years, but had been dropped by the nominating committee), and A. A. Reimer; trustee, W. S. Cramer.

The campaign centered on defeating Mr. Henderson, but everyone else on the nominating committee's ticket except President Leisen and Trustee Little, who were unopposed, was also defeated. The letter ballot count was as follows:

President:	
T. A. Leisen	597
C. R. Henderson	109
Vice President:	
A. W. Cuddeback	367
C. R. Henderson	334
Treasurer:	
J. A. Caird	541
A. A. Reimer	162
Trustees (two to be elected)	
B. C. Little	640
W. S. Cramer	393
H. B. Morgan	370

The new Executive Committee appointed the following Finance Committee: George A. Johnson, chairman; J. Waldo Smith and Frank A. Barbour. This was a clean sweep, Messrs. Keeler, Henderson and Morgan all going overboard.

The Line-Up for 1918-19 Officers

In view of the campaign just closed the composition of the Nominating Committee to propose officers for 1918-19 is of unusual interest. By districts it is: New England, R. S. Weston; Middle, Charles R. Wood; Southern, J. A. Steele; Central, John W. Alvord; Western and Canada, H. Hymmen.

Notwithstanding the unhappy incidents related and the deep-rooted underlying causes the Richmond convention will go down in history as a good one. It is true that war conditions cut down the attendance to six hundred members and guests, but the attendance was representative. The members of the Water-Works Manufacturer's Association did their part most admirably, making a good exhibit in a trying time and providing entertainment that was ample and yet did not intrench upon the more serious objects of the convention.

The technical program was well selected. Its subjects were varied. A large percentage of the papers were eminently practical. All were informing. A few, like E. E. Davis' story of his 45 years' experience with the Richmond water-works, were highly interesting. There were a number of worthy committee reports.

Engineers Dominate Technical Program

Since this is the third or fourth critical period in the history of the Association in the last two decades a little more frank criticism is in order. For years past there has been an undercurrent of dissatisfaction because the engineers play so large a part in the technical proceedings. This was in evidence again at Richmond. Actual count shows that about two-thirds of the papers on the 1917 program were by engineers rather than superintendents, while some of the superintendents who presented papers were engineers by education and experience. Practically all the standing committees are headed by engineers.

As already intimated, the technical program did credit to all concerned. It contained a group of four papers on pumping station design and operation. Water treatment and allied subjects were well represented on both the general program and before the Chemical and Bacteriological Section. A number of papers appear in abstract elsewhere in this issue.

How Superintendents' Day Panned Out

At New York in 1916 Superintendents' Day was largely a fizzle, due in considerable part to electrolysis and private fire protection pyrotechnics. The superintendents rightly protested. This year the responsible officials determined to get different results. They succeeded in submitting a good program, but little of it was by, and not all of it thoroughly suited to, superintendents. In short, the superintendents made practically no response to the strong appeal made to them to submit experience papers—and not many superintendents attended the two sessions designed wholly for them.

If engineers connected with the New York City water department had not filled out the program it would have been scanty indeed. Adverse criticism of the fact that two New York City water-department engineers had two papers each on the morning program and another had one at the afternoon session led Mr. Metcalf to say that he sent out a hundred personal letters to the superintendents asking for contributions to the program, and believed appeals were made by other officials as well. Secretary Diven also sent out two appeals to the membership, asking for volunteers to discuss some one of numerous topics suggested by him, but the appeals fell on barren and stony ground.

W. W. Brush, New York City, told how a trench machine had been used on a 72-in. steel pipe line on Long Island. Other successful experiences were described.

Installment plan payments financed by bonding companies to facilitate the introduction of water and sewerage services in houses of the less well-to-do classes was the subject of a paper by F. C. Jordan, secretary Indianapolis Water Co. This paper, previously presented before the Indiana Sanitary Association (see "Engineering News," Mar. 22, 1917, p. 478) aroused much interest. J. W. Ackerman, Auburn, N. Y., said that his city was financing such conveniences on the installment plan and M. N. Baker urged that where feasible city or water company financing seemed preferable to bringing in a third party, like a bonding company.

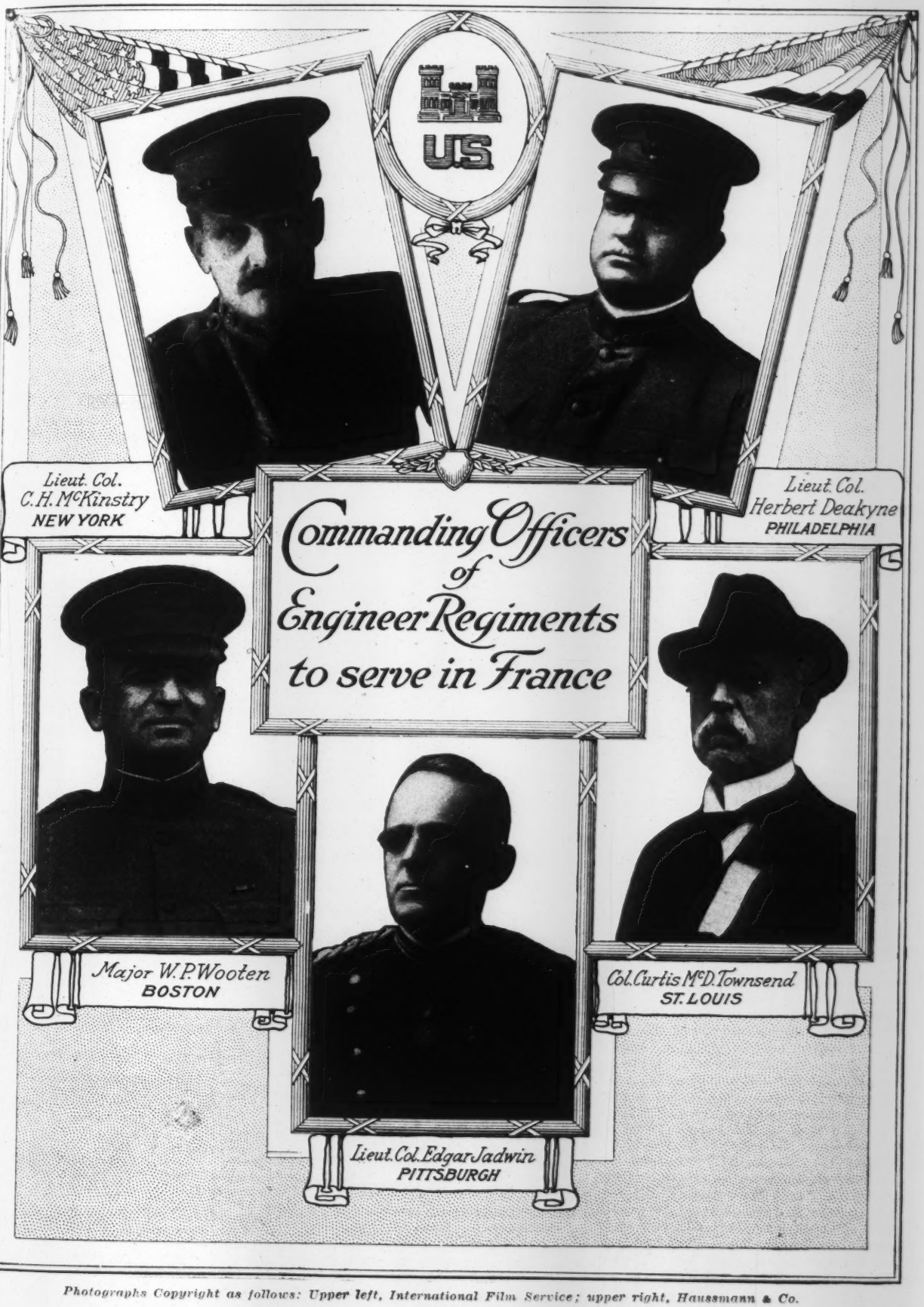
Active and Progress Report Committee

Several committees made final reports. Two—on Consumption and on Cast-Iron Pipe Specifications—showed most gratifying coöperation with like Committees of the New England Water-Works Association.

There was no response from the Electrolysis Committee—the report of which caused so much commotion last year. The existing committee was discontinued, as was also the committee on Standard Specifications for Hydrants and Valves—the latter had really finished its work. For the City Planning Committee, E. P. Goodrich, chairman, sent some lantern slides showing attempts to improve the appearance of water-works structures and grounds. Nicholas Hill reported real progress for the Committees on Private Fire Protection Service and on Classification of Technical Literature.

A carefully considered long final report for the Depreciation Committee, signed by four of the five members, was read by John W. Alvord, chairman, while Jas. A. Hazlehurst in no uncertain terms and tone presented a dissenting opinion on one or two points, though agreeing heartily to the rest of the majority report. The report, and dissenting opinion, will come up for action a year hence.

Radical Changes in Constitution Proposed

The Committee on Constitution, which was inactive through the year and had no report to submit, was discontinued. President Metcalf reported that radical changes in the constitution had been proposed by George A.

U.S.
Lieut. Col. C. H. McKinstry NEW YORK
Lieut. Col. Herbert Deakyne PHILADELPHIA
Commanding Officers of Engineer Regiments to serve in France
Major W. P. Wooten BOSTON
Col. Curtis McD. Townsend ST. LOUIS
Lieut. Col. Edgar Jadwin PITTSBURGH

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Johnson, but that with Mr. Johnson's consent these would not be presented to the convention this year. Instead, Mr. Metcalf proposed, and the convention agreed, that a committee advisory to the Executive Committee be created to consider revision of the constitution and report to the Executive Committee. The latter, in turn, will take up the subject and submit its conclusions to the membership in advance of the next convention, when the whole subject will come up for action.

Water-Pipe Users and Makers Deadlock

Years ago the Association appointed a Committee on Revision of Cast-Iron Pipe Specifications (John H. Gregory now chairman) to consider the specifications adopted in 1908. There has been and still is a deadlock on three major points: (1) Uniform outside diameter for all classes or thicknesses of pipes of the same diameter; (2) chemical composition of the iron; (3) establishing a relation between bending moment and flexure in test bars. Briefly, the four pipe-user members of the committee reported that the other two members, representing the pipe manufacturers, think the 1908 specifications good enough, and in any event are against any change in specifications during war time. The convention authorized the committee to obtain for its guidance the opinion of the members of the Association on the points at issue.

Executive Committee Doings

The old Executive Committee reported that John M. Goodell had been made editor of the Journal, a new office; that a California section of the Association had been formed; and that the Committee recommended the election as honorary member of S. J. Rosamond, Fort Smith, Ark. The recommendation was adopted.

Lucky St. Louis

As usual, the heavy attendance was Wednesday noon, when the next meeting place was chosen, and the associate members or supply men had their one chance to vote. Detroit, Evansville and St. Louis were announced as candidates for the 1918 convention and three-minute limit was imposed on the orators for each city. Marvelous to relate, the three cities did all their talking in a total of ten minutes. After that every one settled wearily down to the expected usual tedious collection and counting of votes by tellers. Then by inspiration or just plain common sense some one suggested that the task of the tellers would be lessened and the patience of the voters relieved—and lunch brought nearer—if the Detroit boosters assembled on the right, the Evansville rooters in the center and the St. Louis enthusiasts on the left. It took just about one minute to show that Commissioner Wall had Superintendent Leisen well beaten, while Evansville simply wasn't in it.

New Appointments Made to Engineer Officers' Reserve

War Department Selects 120 Technical Men for Army Commissions

The War Department, through the Office of the Chief of Engineers, has made public the following list (supplementing similar lists published in this journal), giving the names of those who have accepted, or been recommended for, commissions in the Engineer Officers' Reserve Corps, as of the dates Apr. 10 and Apr. 12, respectively:

MAJORS

Engineer Officers' Reserve Corps

Binckley, George S., Central Building, Los Angeles, Calif.
Cattell, William A., Foxcroft Building, San Francisco, Calif.
Wadsworth, H. H., 405 Customhouse, San Francisco, Calif.
McCullough, Ernest, care of Stone & Webster Corp., 141 Milk St., Boston, Mass.
Jones, Henry L., 30 Church St., New York City.
Schoen, Allen McGee, Atlanta, Ga.
Brown, M. W., 50 Voorhis Ave., Nyack, N. Y.
Weinberg, George S., 120 Broadway, New York City.
Robinson, George P., 849 N. Mariposa Ave., Los Angeles, Calif.

CAPTAINS

Shaver, Archibald G., 11242 S. Oakley Ave., Chicago, Ill.
Jacob, Clarence C., 421 Federal Building, Salt Lake City, Utah.
Hulsart, Charles R., 2340 Seventh Ave., New York City.
Bunker, George H., P. O. Box 664, Wilmington, N. C.
Caccavajo, Joseph, Lansdowne, Penn.
Wright, Frederick E., 2134 Wyoming Ave., Washington, D. C.
Ford, William Ellis, 339 Gazette Building, Little Rock, Ark.
Gordon, Arthur F., 7133 Hermitage St., Pittsburgh, Penn.
Moss, William B., 36 Pommer Ave., Tompkinsville, N. Y.
Woodruff, Eugene C., State College, Penn.
Hill, Edward L., Room 977, 50 Church St., New York City.
Ray, Norman G., Massena, N. Y.
Collings, Edward Z., Room 17, City Hall, San Pedro, Calif.
Murray, Robert H., 10206 Longwood Drive, Chicago, Ill.
Merwin, Eugene W., Room 17, City Hall, San Pedro, Calif.
Olson, John E., Detroit Athletic Club, Detroit, Mich.
Mayberry, Edward L., 472 Pacific Electric Building, Los Angeles, Calif.
Twogood, Ralph S., 1022 Peralta Ave., Berkeley, Calif.
Powell, Orman N., care of Forest Serice, Albuquerque, N. M.
Moeller, Eduard H., 392-4 Pearl St., Buffalo, N. Y.
Crawford, Gilbert H., 272 Hicks St., Brooklyn, N. Y.
Jones, Reid, 2125 River Ave., San Antonio, Tex.
Shuman, Leigh D., Wenonah, N. J.
Bartlett, Samuel C., 77 N. Arlington Ave., E. Orange, N. J.
Peters, Albert A., San Luis Obispo, Calif.
Woodbury, William H., 510 Wolvin Building, Duluth, Minn.
Tompkins, Elbert W., 856 Myrtle Ave., Albany, N. Y.
Catlett, George F., P. O. 675, Wilmington, N. C.
Coomer, Ross M., 311 United Bank Building, Sioux City, Iowa.
Hussey, William F., 876 High St., Bath, Maine.
Cook, Paul Darwin, 317 21st St., Sioux City, Iowa.
Farrington, Thomas H., Owego, Tioga County, N. Y.
Astell, Leonard K., 613 Paladio Building, Duluth, Minn.
Byrnes, Walter M., 1505 3d St., N. W., Washington, D. C.
Werth, James R., Lighting Department, General Electric Co., Schenectady, N. Y.
Dobson, Gilbert C., 4222 Forest Ave., Kansas City, Mo.
Enger, Arthur L., University of Arizona, Tuscon, Ariz.
Starbird, Chester B., 87 E. Main St., Marlboro, Mass.
Stover, Frederick H., Crescent Hill Purification Plant, Louisville, Ky.
Miller, Lorimer D., 1458 Belmont St., Washington, D. C.

FIRST LIEUTENANTS

Machesney, H. C., Baden, Penn.
Fernow, B. E., Jr., 432 Lafayette Place, Milwaukee, Wis.
Sheibley, E. G., care of International Smelting Co., Miami, Ariz.
Woodhull, Lean R., 131 Wall St., Bethlehem, Penn.
Schaeffer, George H., 1354 Mineral Spring Rd., Reading, Penn.
Grohmann, A. T., U. S. Engineer Office, Chicago, Ill.
Belcher, P. William, U. S. Engineer Office, 405 Customhouse, San Francisco, Calif.
Lee, Charles H., 1103 Central Building, Los Angeles, Calif.
Jackson, Edward C., Hdq. Prov. Engr. Bn., 7th Div., Camp Stewart, El Paso, Tex.
Lippincott, James J., 10 Crane Ave., White Plains, N. Y.
Watson, John A., 1015 Warren Ave., Bremerton, Wash.
Wood, Benjamin R., Room 700, Army Building, New York City.
Knight, Alexander C., 348 E. 25th St., Baltimore, Md.
Chittenden, Albert F., 4106 Burke Ave., Seattle, Wash.
Goodspeed, G. F., Jr., Corvallis, Ore.
Evans, Richard T., U. S. Geological Survey, Sacramento, Calif.
Judge, William J., New Madrid, Mo.
Miller, Harold B., 1217 Oliver Building, Pittsburgh, Penn.
Nash, John F., 1460 Winchester Ave., Lakewood, Ohio.
Taylor, Edward H., care of The Austin Co., 14230 Euclid Ave., Cleveland, Ohio.
Cross, Lloyd A., E. Liberty Y. M. C. A., Pittsburgh, Penn.
Schless, Jacob T., 3226 Woodland Ave., Kansas City, Mo.
Grunow, William R., Morenci, Ariz.
Thornhill, T. W., 14 Parkwood Ave., Charleston, S. C.
Russell, George S., Box 342, R. F. D. No. 6, Independence, Mo.
Eager, Vernon M., 211 S. Garden St., Bellingham, Wash.
Jones, Allen A., 333 Valentine Building, Toledo, Ohio.
Value, Burnside R., Buzzards Bay, Mass.
Hubbard, Dwight G., Morenci, Ariz.
Ross, Henry B., 19 Holly St., Cranford, N. J.
Kean, Delprat, 501 North J St., Tacoma, Wash.
Radford, Robert A., 421 Norwood Ave., Buffalo, N. Y.
Brantly, Edgar C., Tuscaloosa, Ala.
Slauson, H. L., Jr., 723 Hill Ave., Wilkinsburg, Penn.
Lawler, John M., Carrollton, Ohio.
Sweet, Guy Vernon, 1 Daniel St., Albany, N. Y.
Haemmerlein, Victor E., East Aurora, N. Y.
Pearson, James T. M., 4128 South Benton, Kansas City, Mo.
Colhoun, Daniel W., Wadsworth Hall, Arrochar, N. Y.
Miller, Buckingham, 15 Duncklee St., Newton Bldg., Mass.
Paine, Clifford E., Ambridge, Penn.
Garges, Eugene W., Doylestown, Penn.
Semon, Edward G., 563 3d St., Albany, N. Y.
Harrah, Orin Wilson, Poplar, Mont.
Braly, Raymond F., 428 N. Mesa St., San Pedro, Calif.
Legier, Edward W., 2911 Grand Boulevard, W., Detroit, Mich.

SECOND LIEUTENANTS

Wasson, J. H., 914 Karpen Building, Chicago, Ill.
Smith, William A., Rifle, Colo.
Krauss, Walter F., 508 East 89th St., New York City.
Neuman, David L., 4210 Broadway, New York City.
Brunet, Meade, 102 Pierrepont St., Brooklyn, N. Y.
Altman, Frank S., Atchison, Kan.
Toklas, C. F., Union League Club, San Francisco, Calif.
Kierstead, Friend H., 66 Livingstone Ave., Pittsfield, Mass.
Graham, Germain P., 280 Quail St., Albany, N. Y.
Rowland, Clifford F., R. F. D. No. 1, Waterbury, Conn.
Ward, Butler Etter, 313 Lenox Road, Schenectady, N. Y.
Carruthers, E. E., 801 Fifth Ave., S. Lewiston, Mont.
Harvey, Earl Evan, care of Biscayne Engineering Co., Miami, Fla.

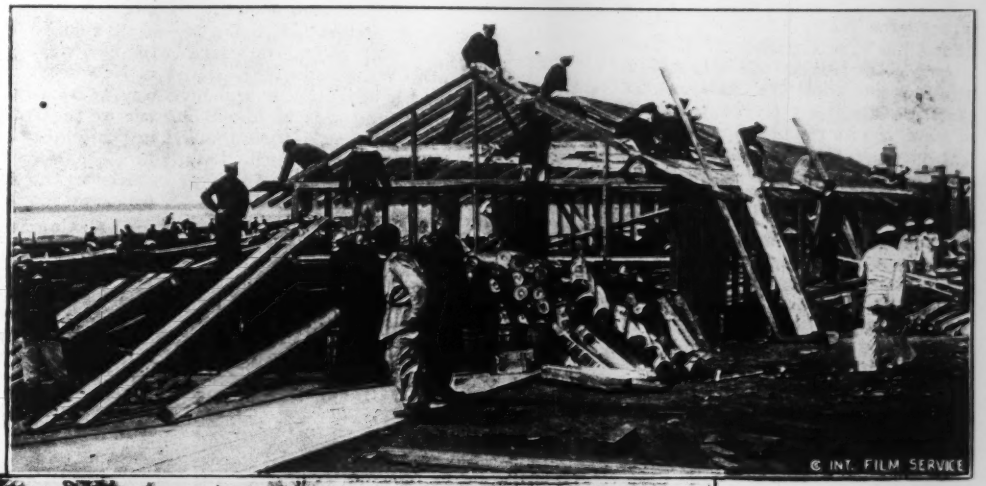
Goethals President of New Engineering Firm

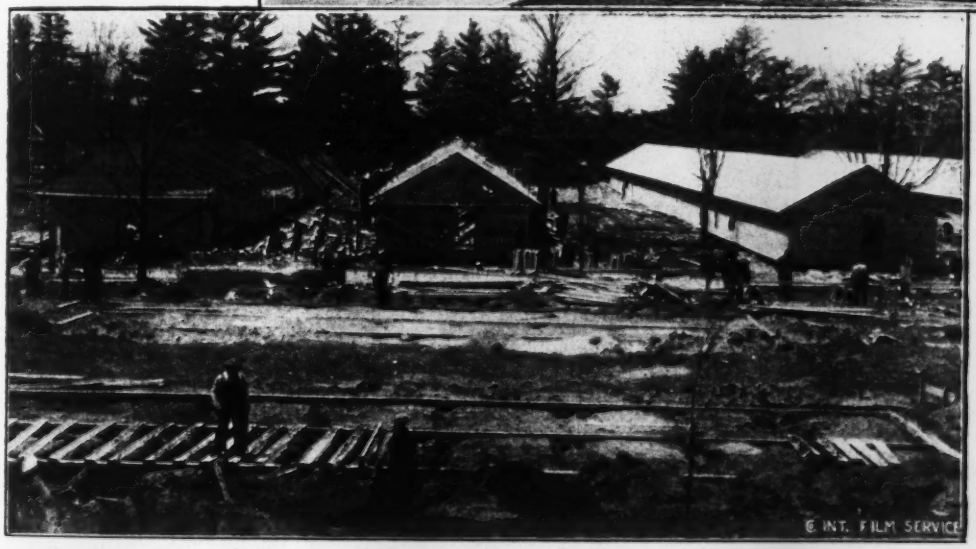
Gen. George W. Goethals has become head of a new engineering firm, to be known as Goethals, Jamieson, Houston & Jay, Inc., the organization being a consolidation of the firms of George W. Goethals, of 43 Exchange Place, and Jamieson, Houston & Graham, of 40 Wall St. In confirming the establishment of the new organization its vice president, R. E. Graham, said: "The consolidation became effective May 9. Our offices will be at 40 Wall St. General Goethals has been elected president of the company."

George M. Wells, who has been in charge of the offices of General Goethals, has moved into the new offices of the company at 40 Wall St. Maj. Charles C. Jamieson has returned to active service in the army. When conditions become normal both he and General Goethals will devote their entire time to the company.

Cities for New Army Built at Record Speed

Navy recruits are reporting at the Newport, R. I., training barracks in such large numbers that additional barracks have to be erected. Some of the men waiting to join their ships are doing the work. Three of these barracks, each to hold 112 recruits, have been erected at the rate of one per day.





In wooden barracks such as these, which are being erected at Plattsburg, the Engineer Officers' Reserve Corps will live while receiving its training. This is the modern answer to the necessity for quickly housing troops. It is somewhat of an improvement over tents, which are harder to obtain than lumber and resident labor.

Davidson, Ward F., 608 E. Madison St., Ann Arbor, Mich.
Loebenstein, J., 1 West 92d St., New York City.
Mail, Eugene F., Robinson, Ill.
Nolte, Robert W., 1505 State St., New Orleans, La.
Crandall, J. S., 46 Sprague St., Malden, Mass.
Rees, Louis Du Bois, Gray Apartments, Wilkinsburg, Penn.
Constantine, Edward C., 29 Court St., White Plains, N. Y.
Storar, John H., 632 Melrose Ave., Ambridge, Penn.
Hess, James R., Ambridge, Penn.
Rush, William J., care of American Bridge Co., Ambridge, Penn.
Royal, Joseph N., care of Barrett Co., 17 Battery Place, New York City.
Ettinger, John D., State Highway Department, Watertown, N. Y.

Finish Camp Buildings in Record Time

By teamwork between contractors, dealers in lumber and building materials, and civic organizations the cantonment buildings at Fort Oglethorpe, Ga., to accommodate candidates for commissions in the Officers' Reserve Corps, were completed in 12 days. The rate of progress was such that the daily delivery of lumber amounted to 100,000 ft.; it was erected as fast as received. The contractor was the T. S. Mondy Co., for whom T. W. Knight acted as general superintendent.

Indianapolis Sewage-Disposal Commission Chosen

The City of Indianapolis will build sewage-disposal and garbage-disposal works, through the agency of a Sanitary Commission consisting of the city engineer, an engineer chosen by the State Board of Health and a third engineer chosen by the first two. By virtue of his office, B. J. T. Jeup is the city engineer member. The State Board of Health named as the second member J. Craven, engineer of the Terre Haute Water Co., but previously on the Ohio River studies of the United States Public Health Service, and still earlier chemist of the Indiana State Board of Health. Mr. Jeup and Mr. Craven chose as the third member C. H. Hurd, vice president and engineer of the Indianapolis Water Co. Each member of the commission will receive $3600 a year until the disposal works are built, then $600 a year. The city is authorized to issue bonds for about $2,500,000 to carry out the improvements. The commission has appointed as consulting engineers George W. Fuller, of New York, and Paul H. Norcross, of Atlanta, Georgia.

Personal Notes

G. P. Hawley, resident engineer, Cedar Rapids Manufacturing and Power Co., Cedars, P. Q., Canada, calls attention to an error ("Engineering News," Mar. 29, 1917, page 535) designating H. S. Slocum as resident engineer of that company. Mr. Hawley has been resident engineer on the Cedars development work since the beginning of construction, in April, 1912. Mr. Slocum was mechanical engineer at Cedars in 1913 in charge of the construction of the power house and tailrace.

John J. Gantl, formerly locating engineer with the United Fruit Co. in Panama and Costa Rica, and more recently associated with the Interstate Commerce Commission's valuation department at Chattanooga, Tenn., is now assistant engineer with the Chicago & Northwestern Ry. at Chicago.

Chesapeake & Ohio Ry. announces the following divisional and district changes and appointments: C. S. Falconer, assistant superintendent Allegheny district and branches, Clifton Forge division, Hinton, W. Va.; F. D. Beall, division engineer, Clifton Forge division, Clifton Forge, Va.; J. W. Haynes, superintendent, Greenbier division, Ronceverte, W. Va.; W. E. Webb, superintendent, Guyandot division, Logan, W. Va.; R. W. Mumford, division engineer, Guyandot division, Logan, West Virginia.

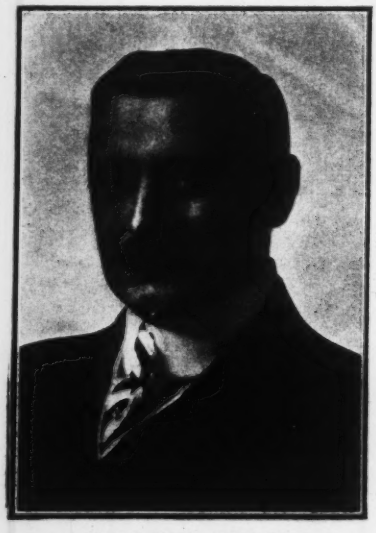
G. A. Barcroft, who has been for the past year in charge of the construction of Fort MacArthur, near Los Angeles, Calif., has recently been transferred to the United States Engineer Office at Galveston. He will take charge of the construction of new forts there.

Lyman E. Bishop, recently deputy state engineer of Colorado, has resumed private practice as a civil-hydraulic and irrigation engineer, with offices in the First National Bank Building, Denver, Colorado.

H. H. Harsh, division engineer, maintenance-of-way, Baltimore & Ohio R.R., at Garrett, Ind., has been appointed division engineer at Pittsburgh, Penn.

J. Vipond Davies has recently been appointed vice president and a director of the Hudson & Manhattan R.R., to succeed Richard W. Meirs, deceased. Born in South Wales in 1862, Mr. Davies received his education at Queens College, England, and was engaged in coal mining, steel manufacturing and other engineering work until 1889, when he came to New York and was employed as engineer with the late Austin Corbin, principal assistant engineer on the tunnel under the East River for the East River Gas Co. Since 1894 he has been a member of the firm of Jacobs & Davies, consulting engineers, and has served as chief engineer of the Hudson & Manhattan R.R.; chief engineer in charge of design and construction, West Virginia Short Line R.R. and Kanawha & Pocahontas R.R. in West Virginia; chief engineer of the Atlantic Avenue Improvement, Long Island R.R.; consulting engineer for the Brooklyn Rapid Transit Co.; consulting engineer for the City of Detroit on the water-supply tunnel under the Detroit River; and engineer in charge for contractors of the New York terminal improvement of the New York Central R.R. Mr. Davies designed and built four tunnels under the Hudson River and under New York, Jersey City and Hoboken for the Hudson & Manhattan R.R., and has been construction engineer for 26 aqueduct tunnels in Mexico. He served on the board of three consulting engineers in the construction of the Moffat Tunnel near Denver, and his firm prepared the original studies for the Pennsylvania R.R. tunnels under the North and East Rivers, New York City. Mr. Davies was engineer in charge of the construction of the Hales Bar Dam across the Tennessee River at Chattanooga.

New Vice President of Hudson & Manhattan Railroad



J. VIPOND DAVIES

Percy E. Barbour, managing editor of the "Engineering and Mining Journal," has been appointed deputy to Maj. George F. Chandler, who heads the new state constabulary to be formed in New York. He will have headquarters in Albany. Mr. Barbour is a member of the American Institute of Mining Engineers, the Mining and Metallurgical Society of America and an officer in the 22nd Regiment, N. Y. Engineers.

C. C. Cunningham, roadmaster of the Chicago, Rock Island & Pacific Ry., at Liberal, Kan., has been made division engineer of that road, with headquarters at Dalhart, Tex., succeeding A. J. Wise, resigned.

C. F. Burrell, engineer and roadmaster of the Kentucky & Indiana Terminal R.R., at Louisville, Ky., has been appointed engineer of maintenance-of-way of that road. James McDonald has been made roadmaster.

J. H. Charlton, assistant engineer of the Virginian Ry., has been appointed chief engineer of the Boyne City, Gaylord & Alpena R.R., with headquarters at Boyne City, Mich. He succeeds M. G. Gates, resigned.

Alexander Allaire has become associated with Fraser, Brace & Co., contractors, New York City, as vice president of the company.

C. Arthur Poole has been appointed deputy city engineer of Rochester, N. Y. Mr. Poole was appointed to his present position a short time before the death of Frederick T. Elwood, city engineer, and will have charge of the city engineering department until a successor to Mr. Elwood is appointed.

Marvin H. Mooney has been appointed city engineer of Trenton, Missouri.

Christopher Johnson has been appointed city engineer of Warrensburg, Missouri.

L. M. Roessler has been appointed chief engineer of Fremont, Nebraska.

A. J. Warren has resigned as engineer of the Waha-Tammany district of the Idaho State Highway Department. A. W. Burney will succeed him.

Fred H. Forster, head draftsman with the Idaho State Highway Department in the Clearwater district, has been appointed laboratorian in the strength of materials department at the Brooklyn (N. Y.) Navy Yard.

Dr. John S. Billings has resigned as deputy health commissioner of New York City.

E. L. Harshbarger, who has been for the past two years a surveyor in the

United States General Land Office, has left the Government service to take a position with Remhart & Donovan Co., Oklahoma City, as designing engineer in reinforced concrete.

C. A. Lyford and H. E. Brinckerhoff announce the formation of a partnership with the firm name of Clark & Lyford, for the practice of forest engineering, with offices at 15 East 40th St., New York City. The firm will act as Eastern agents for Clark & Lyford, Ltd., Vancouver, B. C., Canada.

Albro Gardiner has been appointed city engineer of Kirkland, Wash.

A. F. Damon, Jr., has been appointed to the newly created office of director of public works of Upper Darby Township, Pennsylvania.

T. Coleman du Pont, Wilmington; Josiah Marvel, New Castle County; Walter O. Hoffecker, Kent County, and Joseph E. Holland, Sussex County, have been appointed by Governor Townsend members of the new Delaware State Highway Commission.

George R. Stearns, formerly of the engineering firm of Stearns & Castor, Philadelphia, has formed a new partnership under the name of Stearns, Woodnut & Schmohl, with offices in the Stephen Girard Building, Philadelphia, and 150 Fourth St., Williamsport, Pennsylvania.

C. H. Knowles, office engineer, Roadmaster's Department, Multnomah County, Oregon, at Portland, has been appointed assistant roadmaster by the Multnomah County Commissioners. He will take up the work of road viewing which has been done until lately by Herbert Nunn, now state highway engineer of Oregon.

Lieut.-Col. William V. Judson, Corps of Engineers, U. S. A., formerly commissioner of the District of Columbia, has been appointed military attaché to accompany former Secretary Root on the American mission to Russia.

M. S. Dutton, chemist in charge of filter plants for the Central Illinois Public Service Co., has resigned to become superintendent of filtration of the Bubbly Creek filter plant of the Chicago Union Stockyards and Transit Co. C. A. Jennings continues in general charge of the plant.

F. W. Mohlman, assistant chemist, Illinois State Water-Survey, has resigned to take charge of the sewage-experiment station at New Haven, Conn. O. M. Smith, for several years in charge of the filtration plant at Little Rock, Ark., takes Mr. Mohlman's place.

Fred L. Hargett has resigned as assistant resident engineer in charge of road improvement work at Monroe, La., to become superintendent of roads and bridges of Bowie County, Texas, a newly created position. His headquarters will be at Boston, Texas.

R. G. McBride, Elko, Nev., has been appointed assistant engineer of the State of Nevada.

B. L. G. Rees, formerly assistant engineer with the New York Public Service Commission, is now with the Foundation Co., New York City, in the superstructure department.

Ernest I. Lewis, Indianapolis, who has made a study of public-utility regulation, John W. McCardle, Indianapolis, and William J. Wood, formerly chairman of the old Railroad Commission of Indiana, now attached to the Interstate Commerce Commission at Washington, D. C., have been named by Governor James P. Goodrich as the three new members of the Indiana State Public Service Commission, to succeed Chairman Thomas Duncan and Commissioner James L. Clark and to fill a third vacancy. H. O. Garman, Purdue University, will remain chief engineer to the commission.

Charles E. Hewes, for the past year city manager of Alhambra, Calif., has been appointed city manager of Alameda, Calif., at a yearly salary of $4000.

L. P. P. Reese has resigned as junior engineer with the United States Reclamation Service, at Browning, Mont., to become assistant city engineer of Fort Collins, Colo.

Willard B. Hastings, who had been for some time with the Alaska Engineering Commission engaged on the Government railway project, died at Anchorage, Alaska, on Apr. 21, at the age of 62. Mr. Hastings, a native of Michigan, had been identified with the development of Alaska for 23 years. He served in various engineering capacities in Alaskan territory and was at one time deputy United States marshal at Unalaska.

Herbert M. McIntosh, consulting engineer, Burlington, Vt., a member of the Vermont State Conservation Commission, has been appointed state engineer by Governor Graham, an office created at the recent session of the Vermont legislature.

C. J. Rist has been appointed division engineer of the Pere Marquette R.R., at Saginaw, Mich., to succeed J. E. Johnson, resigned.

M. H. Doughty, assistant to chief engineer of the Delaware, Lackawanna & Western R.R., at Hoboken, N. J., has been appointed division engineer, to succeed G. T. Hand.

Engineering Societies

Chattanooga Engineers' Club organized in August, 1916, has recently elected the following officers: President, J. Y. Bayliss; vice-president, J. A. Fairleigh; secretary and treasurer, A. F. Mellen and board of governors, O. B. Agner, W. G. Atwood, G. W. Knight, W. H. Sears and D. H. Wood.

Municipal Engineering Society, Flint, Mich., has elected C. E. Ridley and F. W. Engdahl, president and secretary, respectively.

Nebraska Association of Members of the American Society of Civil Engineers was addressed, Apr. 10, by H. S. Crocker, consulting engineer, Denver, on "Certain Trying Features in the Construction of Reinforced-Concrete Viaducts." About 30 attended the meeting, which was held at Lincoln.

The Spokane Engineering and Technical Association, through its board of directors, recently elected Morton McCartney, president. Mr. McCartney is city engineer of Spokane. Other officers for the ensuing year are: P. E. Morgensen, first vice president; W. H. Linney, second vice president; Carl Uhden, third vice president; B. J. Garnett, secretary-treasurer.

The Astoria Society of Engineers was recently organized at Astoria, Ore., starting out with a membership of 12. The new organization will be affiliated with the Oregon Society of Engineers as a branch. The object of the society is the promotion of good fellowship among its members and efficiency of modern engineering methods in making public improvement. Meetings will be held twice a month. The officers of the society are: President, A. C. Rose; vice-president, R. R. Bartlett; secretary-treasurer, L. D. Williams.

The Engineers' Club of Sacramento was recently formed in that city, with temporary headquarters in the Forum Building. The objects of the club are the promotion of the social and business interests of its members, the advancement of engineering knowledge and the maintenance of a high professional standard. The officers elected are: President, Maj. Paul M. Norboe; vice president, G. R. Winslow; secretary, Albert Givan.

The Oregon Society of Engineers of Portland, Ore., held its regular meeting Saturday evening, May 12. H. N. Lawrie opened a discussion of the proposed Telephone Interchange Ordinance, in which representatives of the Public Service League and the telephone companies participated.

The Engineering Society of Buffalo, at a business meeting held Wednesday evening, May 9, elected the following officers for the ensuing year: President, F. A. Lidbury, of Niagara Falls; vice president, D. W. Sowers; secretary, F. B. Hubbard; treasurer, W. M. Dollar, and directors, H. B. Alverson and F. E. Cardullo.

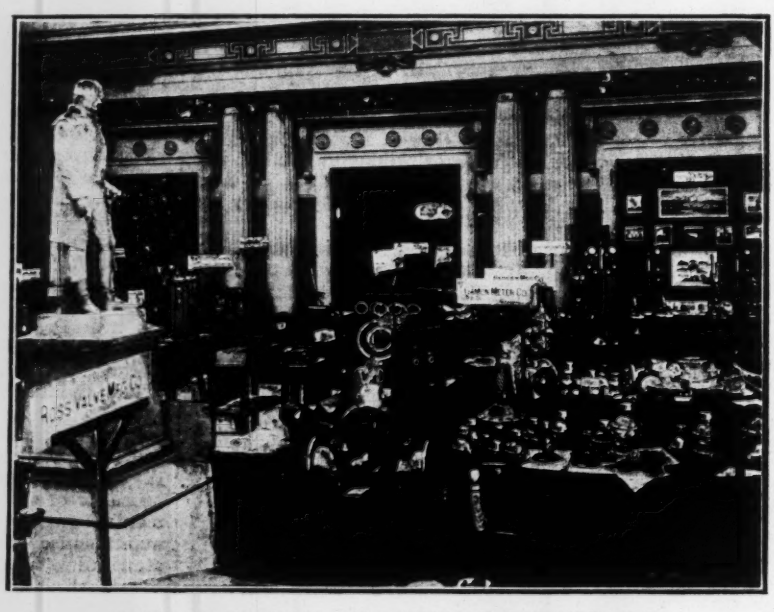
The Engineers Society of Western Pennsylvania is now housed in its new quarters, rooms 565-569, Union Arcade Building, Fifth Avenue and William Penn Way, Pittsburgh, Penn.

The Brooklyn Engineers' Club will meet Thursday evening, May 17, for an informal library talk, by Frederick Auryansen, bridge engineer of the Long Island Railroad, on "The Uses of Concrete in Railroad Work." Final action will be taken on the proposed change in the constitution of the club, which authorizes the board of directors to remit the dues of members actively in the Federal service in time of war. A June "Dinner to the Ladies" has been arranged for Thursday, June 7, at the Marine and Field Club.

Novel Designs Exhibited at Water-Works Convention

Thirty-Three Exhibitors Show a Variety of New Equipment and Novel Apparatus

The exhibition of the water-works supply and material concerns held during the American Water-Works Association convention in Richmond, Va., May 7-11, was perhaps one of the most interesting of the displays which have been held in connection with the convention in recent years. Completely filling the Palm Room of the Jefferson Hotel and overflowing into the corridors, in point of size it showed the effect of the international situation only slightly, and by reason of its dominating features pointed the direction in which advance is being made. Purification methods, the nice regulation of chlorine, and mechanical apparatus to increase production and lower costs both in the shop and in the field were the points which showed the most marked development. The ultra violet ray and the most recently developed types of filter bottoms were prominently exhibited, and chlorine apparatus controlled by pitot tubes, which automatically regulated the quantity of chlorine to the amount of water flowing, were shown in operation.



PART OF EXHIBITS AND SOME OF THE NOTABLES

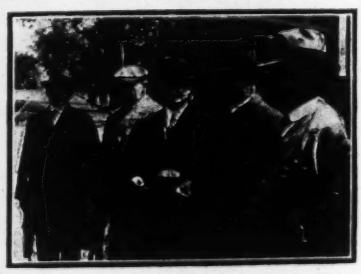
The usual line of staple brass goods, meters and pipe fittings held a prominent part in the show. The list of manufacturers who exhibited is as follows (a very few of these reserved no space but had representatives at the exhibit): Allis-Chalmers Manufacturing Co., American Bitumastic Enamels Co., American City, Badger Meter Manufacturing Co., Birch Valve and Manufacturing Co., Builders Iron Foundry, Buffalo Meter Co., Carbic Manufacturing Co., Central Foundry Co., Central Brass Manufacturing Co., Columbian Iron Works, H. W. Clark Co., East Jersey Pipe Co., Eddy Valve Co., Electro Bleaching Gas Co., "Engineering News-Record," "Engineering and Contracting," "Fire and Water Engineering," Ford Meter Box Co., Garlock Packing Co., Gamon Meter Co., Glauber Brass Manufacturing Co., Harrison's, Inc., Hays Manufacturing Co., Hersey Manufacturing Co., Kennedy Valve Manufacturing Co., Lead Lined Iron Pipe Co., Leadite Co., Maritimo Coatings Corporation, Modern Iron Works, Alexander Milburn Co., H. Mueller Manufacturing Co., Mutliplex Manufacturing Co., "Municipal Journal," National Meter Co., National Water Main Cleaning Co., Neptune Meter Co., New York Continental Jewell Filtration Co., Permutit Co., the Pitometer Co., Pittsburgh-Des Moines Steel Co., Pittsburgh Filter Manufacturing Co., Pittsburgh Meter Co., Rensselaer Valve Co., Ross Valve Manufacturing Co., R. U. V. Co., Inc., Sanitary Co. of America, Sanitation Corporation, Simplex Valve and Meter Co., A. P. Smith Manufacturing Co., Standard Asphalt and Rubber Co., Standard Cast Iron Pipe and Foundry Co., Chris D. Schramm & Son, W. P. Taylor Co., Thomson Meter Co., Union Water Meter Co., United Brass Manufacturing Co., United Lead Co., United States Cast Iron Pipe and Foundry Co., Wallace & Tiernan Co., Inc., Water-Works Equipment Co., R. D. Wood & Co., Worthington Pump and Machinery Corporation.

Village Water Systems Aided

Governor Whitman, of New York, has signed a bill authorizing village water commissioners to acquire water pipes laid under public highways in a county in which any part of the village is situated, or an adjoining county.

Plans Transbay Bridge Tunnel at San Francisco

A new plan for a combination bridge and tunnel across San Francisco Bay between Oakland mole and Folsom St. pier, San Francisco, has just been completed by Harlan D. Miller, of the firm of Watson, Davis & Miller, San Francisco, Calif. These plans are to take the place of the $20,000,000 bridge plans recently rejected by the War Department. The new plans provide for a bridge built close to the water on each side of the bay, with wharves and piers where ships can dock extending from each side of the bridge. The tunnel arrangement in the center will provide a clear channel 3000 ft. wide, and will consist of three tubes, two for fast electric trains and one for vehicular traffic. The points at which the roadways enter the tunnel from the bridge are to be marked by lighthouses. The distance from the water line to the top of the tubes will be approximately 45 ft. The estimated cost is $26,000,000.



Nashville Seeks Better Transportation Facilities

The Tennessee legislature authorized the City of Nashville to issue bonds of $5,000,000 for improving the transportation facilities of the city. It is provided that a board of 21 citizens is to be created to consider the best methods of accomplishing this work and that upon the approval of their report by the Board of Commissioners the people are to vote upon it. The city now has under consideration the purchase of the Tennessee Central R.R., which is in bankruptcy, and improving and extending it to form connections with trunk-line railroads. The construction of a railroad to Corinth, Miss., by the city is also being discussed. The measures contemplated include the building of wharf terminals.